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The Surgery of the Equine Cryptorchid

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Introduction

OF the several domestic species that are subjected to routine castration, the horse presents most problems to the veterinary surgeon because, in addition to difficulties of restraint and anaesthesia, it shows a higher incidence of cryptorchidism and scrotal hernia than other animals (with the possible exception of the pig). Cryptorchidism markedly reduces the value of a horse and, consequently, successful removal of the hidden testicle(s) has always been a most useful operation which merited an ample fee. However, lay gelders who, in the past, castrated the majority of colts, realised the formidable nature of rig castration and, like many veterinary surgeons, were loath to undertake the surgical search for the undescended organ. For these reasons cryptorchidectomy developed an aura of a "specialist" operation and in this field of equine surgery the names of Farmer Miles in America and Hobday in Britain were held in high esteem. Both these surgeons practised the operation extensively, demonstrated it over a wide area and wrote about it well before the First World War. Since that time, German veterinarians, especially Silbersiepe, have published impressive figures of "rig" horses operated upon. Of recent years the decline of the horse as a draught animal so reduced the horse population that the demand for cryptorchidectomy became very small. Thus veterinary surgeons who qualified within the last 25 years have had little chance of gaining a wide experience of this branch of surgery. However, with the increasing popularity of the riding horse, particularly the child's pony, there is once more a small, but constant, demand for the castration of rigs. Since 1950, the present writer has had opportunities to study cryptorchidism from the embryological as well as the surgical aspect. This paper forms part of a general study of testicular descent in domestic animals, and its purpose is to relate certain embryological peculiarities of the equine foetus to the relatively high incidence of cryptorchidism in this species, and to attempt to rationalise the surgery of the horse rig.

Embryology

Considered chronologically, and as a function of the gestation period, testicular descent in the horse is much later than in the ruminant. For instance, whereas the testicle reaches the scrotum of the foetal calf by 4 months, it does not descend the inguinal canal of the foal foetus until the last 2 months of pregnancy, although at 3½ months it was comparably placed in the abdomen to the calf gonad (Fig. 1), adjacent to the internal inguinal ring.

Cole and others (1933) in their studies of the hormones of equine pregnancy drew attention to the remarkable growth of the equine foetal gonads between 4 and 9 months of gestation (Fig. 2), although the French physiologist, Colin, had already noted this in 1873. This growth is due to interstitial cell proliferation and causes the testicle of a 7½ month foetus to be as large as that of a mature horse (Fig. 3). During this phase of growth the testicle is much too large to transverse the inguinal canal (Fig. 4). But between 9 and 11 months a remarkable testicular shrinkage occurs, so that at birth the foal testicle is only one-tenth its previous maximum size. The shrinkage which occurs allows inguinal descent (Fig. 5). In the other domestic species observed in this study progressive testicular growth during pregnaney was proportionate to body growth and there was no lag-phase at the internal inguinal ring. However, in the human subject (in which cryptorchidism is relatively common), the testicle lingers at the internal inguinal ring from the 4th to the end of the 6th month (Arey, 1946).

The phase of inordinate growth in the equine foetal testicle corresponds to the period of high blood-oestrogen in the pregnant mare. In this connexion it is interesting to note that experimentally, in laboratory animals, administration of oestrogen to pregnant animals has caused cryptorchidism in the progeny.

During its 5 to 6 months' sojourn at the internal inguinal ring, the attachments of the testicle of the equine foetus grow considerably so that the organ becomes quite loosely attached in the abdomen, and

somewhat separated from the epididymis. This makes it possible in later life for the surgeon to exteriorise the undescended abdominal testicle either at the groin or flank (see Fig. 6), and it also allows independent descent of the epididymis.

Passage of the testicle from the abdomen to the scrotum, which occurs with relative rapidity, is associated with a remarkable change in the gubernaculum (Fig. 7); its composition alters from mature connective tissue to Wharton's jelly and during this phase the gubernaculum undergoes resorption and shortening and thus, apparently, drags the testicle down the canal. When descent is complete there is no gubernaculum left. Naturally, the epididymis descends first and, if the testicle is too large, only the epididymis is pulled down; such "partial abdominal" rigs (Fig. 8) are not uncommon among horse cryptorchids but they have not been encountered in other species. That the epididymis, to which the gubernaculum is attached, may descend independently of the testis illustrates clearly the traction force of the gubernaculum.

If the change in the gubernaculum does not occur at the proper time, or if sufficient gonadal shrinkage does not take place prenatally, the abdominal testicle will probably never descend for, following birth, the renewed gonadal growth which occurs will again make it too large to traverse the inguinal canal.

The structural change in the gubernaculum is presumably due to male hormone, or to a similar steroid substance, for administration of testosterone, or chorionic gonadotropin, to prepubertal Macaque monkeys—in which descent normally occurs at puberty—will cause premature gonadal descent (Engle, 1932; Hamilton, 1937). Such is the basis for leaving a cryptorchid colt until puberty to see if descent will occur. The present writer believes, however, that neither puberty, nor male hormone, materially affects the retained abdominal testicle of the horse but that high inguinal testicles may be favourably influenced by chorionic gonadotropin (interstitial-cell stimulating hormone). However, hormonal treatment of rigs is not justified on surgical grounds, neither should it be used on an animal with a view to rendering it suitable for breeding because a cryptorchid is genetically unsound.

Surgery

Successful castration of equine cryptorchids is very satisfying surgery. Each case constitutes a little problem which is capable of solution by a deductive approach.

Pre-operative Considerations

According to whether or not there have been previous attempts to castrate them, horses presented for cryptorchidectomy fall into two categories:—

(1) Those which have been bought as geldings but which show male sexual behaviour. Such horses show no obvious testicles but scrotal scars indicate that attempts have been made to castrate them on one, or both, sides. Most often, one descended testicle has been removed and no attempt has been made to find the hidden organ, but occasionally there has been an unsuccessful search for a hidden testicle, and, in a few instances, successful castration has been performed and yet male behaviour has recurred—especially in spring. There is no known explanation of the latter case-history.

(2) The second category includes horses of known history which have not previously been presented for castration. In them one, or both, testicles may be hidden.

A knowledge of previous attempts at castration is usually helpful but, occasionally, may be very misleading; the surgeon should take nothing for granted. For example a scrotal scar means only that an incision has been made, but a spermatic cord stump, containing vas deferens and cremaster muscle, means that a testicle has been removed from that side. Examination of the scrotum and inguinal canal of a suspected cryptorchid colt in the standing position is helpful only to the extent that where the testicle is palpable preparations need only be made for a slightly modified castration operation. Where the testicle is not palpable, it may be high in the canal, or in the abdomen, and preparations must be made to enter the abdomen, if necessary. "One hopes for the best, but prepares for the worst." Examination of the abdominal organs *per rectum* sometimes discloses the retained testicle but the method is too prone to error to be a positive aid to the surgeon. One would expect the pattern of sexual behaviour to be a reliable indicator of the presence of a hidden testicle but experience shows that the position is not clear-cut. Where male horses copulate with mares it is usually certain that a testicle is present, but geldings which have been properly castrated will sometimes show penial erection and mount oestrous mares—especially in spring and early summer. Such horses cause much confusion and on a number of occasions in recent years operations on so-called rigs have revealed that they had previously been effectively castrated.

In respect of the optimum age to perform cryptorchidectomy, there seems little justification for postponing the operation beyond the first year. Moreover, if a cryptorchid is found when castrating young foals by the method advocated by Formston (1951), it is no more difficult to remove the inguinal testicle at this age, and the operation is very well tolerated by the suckling foal; if necessary, a laparotomy could equally well be performed at this time.

Surgical Technique

Horses in training should be let down in condition before cryptorchidectomy, and all horses should be starved for 24 hours before being operated on. General anaesthesia is induced by the intravenous administration of chloral hydrate in 10 per cent. solution; for more prolonged interference anaesthesia is maintained by occasional intravenous injections of pentobarbitone sodium.

Although the inguinal method of cryptorchidectomy has been well described, especially by Merillat (1918), the present-day preponderance of pony rigs requires a greater emphasis on the removal of the abdominal testicle by laparotomy. Except where the hidden testicle is palpable in the canal, the possible

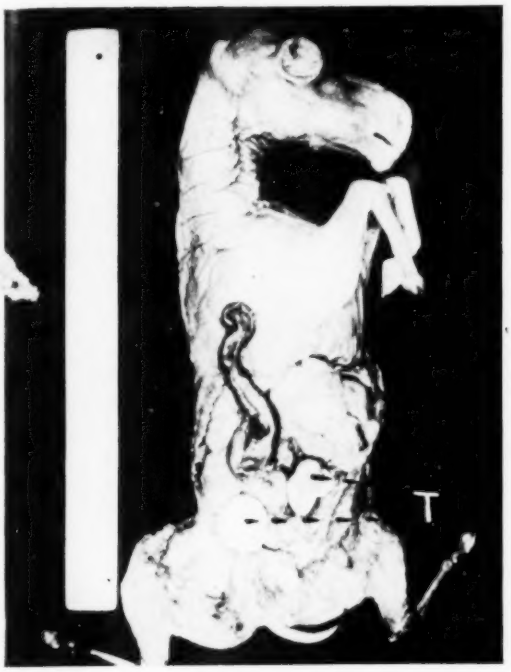

FIG. 1.—Equine foetus of approximately 4 months gestation. The testicles (T) are already near the inguinal rings but are too large to pass through them.

FIG. 2.—Dissection of a 231 day equine foetus showing large abdominal testicles which at this stage are of maximum size.

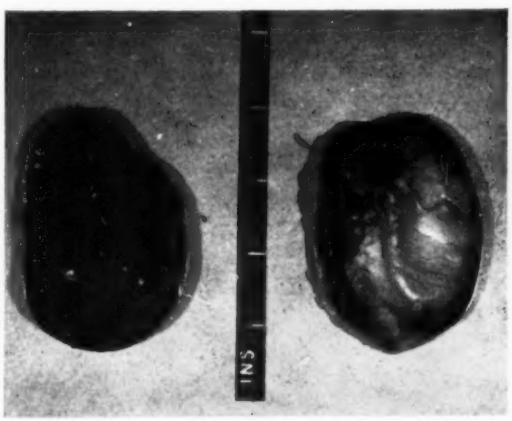

FIG. 3.—A 231 day foetal testicle (left) compared with a testicle (without epididymis) of a 2-year-old Thoroughbred.

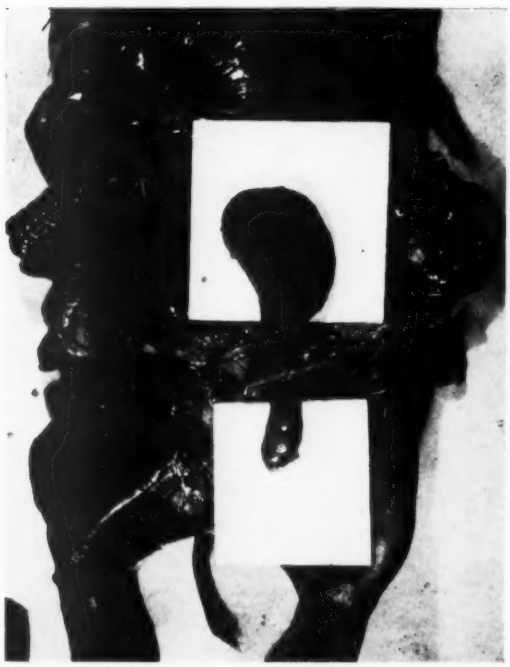

FIG. 4.—Dissection of a 231 day equine foetus showing disparity between the abdominal testicle and the tunica vaginalis which is occupied by the epididymis and gubernaculum.

FIG. 5.—Dissection of a 320 day equine foetus to show relatively small testicles at time of inguinal descent. The left testicle, preceded by the gubernaculum, is just entering the inguinal ring. The right testicle has been retracted *post mortem* into the abdomen.

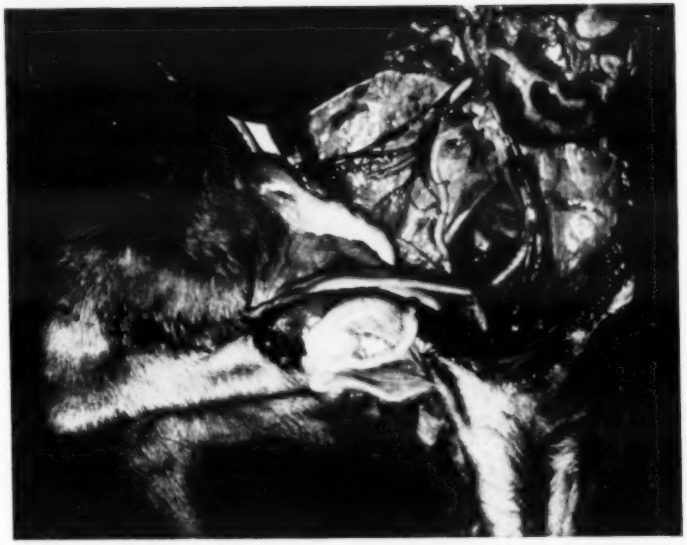

FIG. 6.—Dissection of a 320 day equine foetus to show mobility of testicles. Exteriorisation is possible at the flank (right) or inguinal region (left).

FIG. 7.—Tunica vaginalis of a bovine foetus of FBL 20 cm. opened to show testicle, epididymis and the swollen gubernaculum. The testicle was

FIG. 8.—Testicle, epididymis and gubernaculum removed from a partial abdominal rig in an 8-year-old pony. Most of the testicle consisted of

FIG. 7.—Tunica vaginalis of a bovine foetus of FBL 20 cm. opened to show testicle, epididymis and the swollen gubernaculum. The testicle was

FIG. 8.—Testicle, epididymis and gubernaculum removed from a partial abdominal rig—an 8-year-old pony. Most of the testicle consisted of

FIG. 9.—Poorly developed right tunica vaginalis of a 2-year-old Thoroughbred, inguinal, cryptorchid; photographed during operation. Left testicle weighed 165 g. Right 55 g.; aspermic.

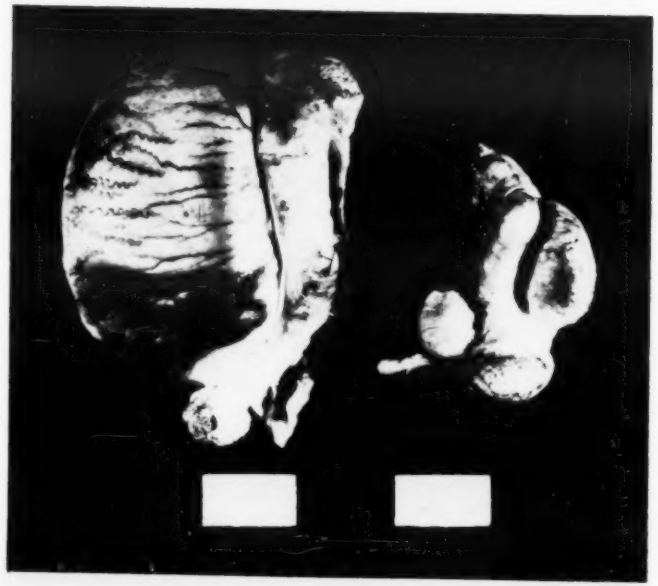

FIG. 12.—Testicular hypoplasia in a 3-year-old Welsh pony. The left testicle has descended and weighed 195 g. The right testicle was high in the canal but had descended as far as possible into a poorly developed tunica vaginalis; it weighed 32 g.

FIG. 10.—A 2-year-old Welsh pony—a double abdominal cryptorchid—showing right-sided laparotomy site; one week after operation.

FIG. 11.—Left-sided laparotomy site in a 2-year-old pony with left testicle in abdomen. Right testicle in scrotum. Photographed two hours after operation.

FIG. 13.—Dissection of a 320 day equine foetus-in which, by abdominal traction on the descended testicle, the tunica has become inverted.

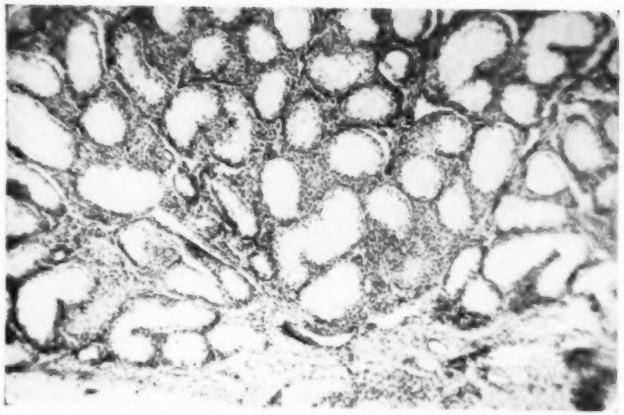

FIG. 14.—Transverse section of left abdominal testicle of a 7-year-old Thoroughbred cryptorchid; tubules narrow and aspermic. Large volume of interstitial tissue. Right testicle had been removed previously.

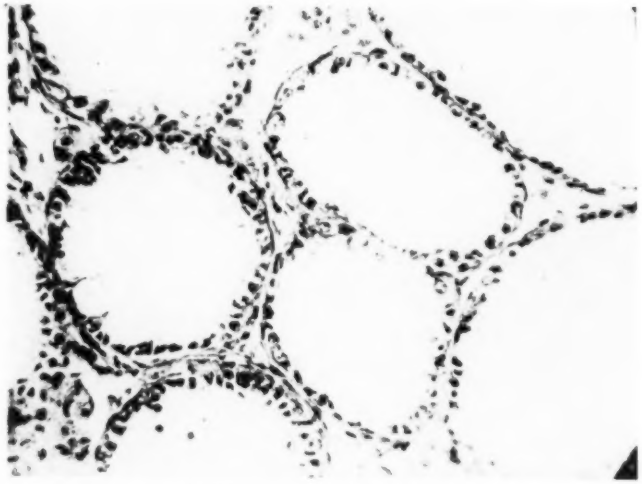

FIG. 15.—Transverse section of the inguinal testicle of a 3-year-old Thoroughbred.

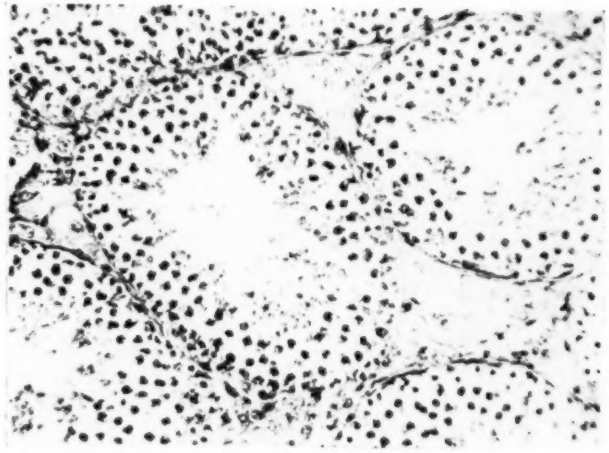

FIG. 16.—Transverse section of the scrotal testicle of same horse as in Fig. 15.

need of laparotomy should be prominent in the surgeon's mind and, accordingly, two separate sterile packs of instruments should be prepared. In all cases, therefore, the aim is to find the testicle by inguinal exploration, and, if necessary, to continue the search in the abdomen by means of flank laparotomy. In order that all contingencies may be catered for, the operative technique should be planned on a logical sequence of procedures, which will now be described.

Inguinal Exploration

The anaesthetised horse is restrained in dorsal recumbency and prepared as usual for cryptorchidectomy, the whole rear of the animal being finally covered by a large drape which has a central hole giving access to the genital area.

The scrotal region is inspected and where a scar of a previous incision is present, this side is first investigated for evidence of satisfactory castration. Alongside the scar a careful, but deliberate, incision is made through the skin and dartos, large enough to accommodate the hand. The knife is laid aside and the exploration continued by blunt dissection, the aim being to find the severed spermatic cord stump. When present, this is usually found adhering distally to the scrotal scar where it causes a puckering of the skin. The cord is isolated and its several components, particularly the cremaster muscle, recognised; a two-inch length of it is excised with the emasculator so as to ensure that no testicular tissue remains. Where no spermatic cord is found in a horse with a scrotal scar, the subsequent surgical procedure is the same as that employed in a case which has not previously been incised and in which no testicle is palpable. The scrotal area of the latter is incised in the manner described above and the operation continued by blunt dissection. In both cases now the aim is to find a tunica vaginalis.

The hand, dressed with antiseptic cream, is inserted towards the external inguinal ring; this gives the right direction to the operator who then parts the loose connective tissue, being careful to avoid the plexus of veins, which are very large in mature cryptorchids, and seeks a glistening, whitish, cylindrical structure, projecting downwards to the external inguinal ring. If the tunica contains a testicle it is obviously more easily recognised; when it contains epididymis only it is much smaller, and when it accommodates neither organ it is poorly developed, or absent. Even when the testicle is present the tunica is never fully developed and this makes its exteriorisation difficult (Fig. 9). It should be secured by means of two fixation forceps and opened between them. The testicle, if present, is ablated as in normal castration. The tunica is then twisted into a pedicle, ligated with No. 1 to 3 catgut, as near to the inguinal ring as possible, and excised distal to the ligature.

In the "partial abdominal rig," where the incised tunica contains epididymis only, the latter is withdrawn as far as possible and the tail of the organ, which is attached to the fundus of the vaginal sac, is recognised. Steady traction is now applied to the free part of the epididymis, with a view to withdrawing the testicle from the abdomen. The ease with which the abdominal testicle may be procured obviously depends on the size of the internal inguinal ring in relation to the diameter of the retained testicle. In some cases it may be readily withdrawn but in the majority, dilatation of the ring will be required. Accordingly, first one finger is forced through the ring and further traction applied to the epididymis; if this fails, two fingers are forced through and traction again applied. The foregoing procedure usually succeeds but in the rare case where the testicle is not forthcoming the difficulty may be due to cystic dilatation and then an attempt must be made to rupture the testicle with a finger, or drain it by means of a trocar and cannula. Teratomatous testicles usually are not very large but their firm structure and rigid shape may cause difficulty in bringing them through the inguinal ring.

In the case of a "partial abdominal rig" in which traction on the epididymis and two-finger dilatation of the internal inguinal ring fails to bring the testicle from the abdomen the surgeon is faced with 3 alternatives:—

(a) To enlarge the ring still further and to procure the abdominal testicle by inserting the whole hand. Owing to the impossibility of repairing the wound thus caused this procedure carries a grave risk of subsequent bowel prolapse.

(b) By introducing one or two fingers, to hook the vascular part of the spermatic cord, withdraw it alone, and sever it with the emasculator. This is as effective as orchidectomy.

(c) To abandon the inguinal operation and continue by flank laparotomy. In the pony this is probably the most reasonable alternative and it will now be described. In the case of the double rig, however, before the abdominal section is begun, it is essential to search the inguinal canal on the other side. Also, if an epididymis is present on either side its gubernacular attachment to the vaginal sac should be divided so that the whole organ may be subsequently drawn into the abdomen when the testicle is exteriorised at the flank.

In pony rigs in which the inguinal search reveals that the tunica vaginalis is very small, or absent, no attempt is made to enter the abdomen from the inguinal canal; the flank method is preferred.

Flank laparotomy

Experience has shown that horses can well tolerate a laparotomy immediately after an unsuccessful inguinal exploration.

The abdomen is opened by a vertical incision in the middle of the flank on the side of testicular retention (Figs. 10 and 11). Where both testicles are intra-abdominal the side of entry is immaterial although the right-handed operator will find it easier to explore the posterior abdomen from the right side. Accordingly, the horse is placed in lateral recumbency, 3 legs being hobbled together, and the upper hind-leg being drawn back by a separate rope. A liberal area of the flank is prepared for surgery and freshly sterilised drapes and instruments are employed. At this stage the anaesthesia may be lightening and an intravenous injection of sodium

pentobarbitone may be needed to restore it to the surgical plane. The incision must be long enough to accommodate the hand. There is considerable muscle, chiefly internal oblique, at this site and one or two arteries may require ligation. There is usually a substantial layer of fat overlying the peritoneum but it is a simple matter to force a finger right through the composite layer of transverse aponeurosis, adipose tissue and peritoneum. The peritoneal wound is now enlarged by gradual insertion of the whole hand into the abdomen. The testicle of the "partial abdominal rig" is usually at, or near, the internal inguinal ring, but in true abdominal cryptorchids the well-developed mesorchium allows the testicle to be variously situated between the kidney and inguinal ring. Thus, sometimes, as soon as the abdomen is entered the testicle "comes into the hand" but where this happy episode does not occur a systematic search of the abdomen must be made. In the case of the "partial abdominal rig" the hand is passed, with its palmar surface skirting the parietal peritoneum, to the internal inguinal ring where the testicle may be procured and it, together with the freed epididymis, is exteriorised at the flank where it is ablated with the emasculator. The testicle of the true abdominal rig is sought by using the vas deferens as a guide. To this end, the hand in the abdomen is passed to the entrance of the pelvis, where the bladder is palpated and its lateral ligament identified. In this fold of peritoneum, near to the neck of the bladder, the vas will be recognised—it feels like a piece of parcel-string. If it is traced away from the bladder it will lead the surgeon to the epididymis, and the epididymis is attached by a variable length of "anterior" gubernaculum to the testicle. This variable separation of the epididymis from the testicle sometimes prevents complete exteriorisation of the epididymis, and instead of performing the ablation with an emasculator, the section must be done by introducing the ecraseur so that the chain is placed deep to the epididymis. The writer believes, however, that it is not essential to remove the epididymis. In a double abdominal rig, the other testicle is sought in the same way and may be ablated—with a little difficulty—through the original incision.

The abdominal wound is sutured by means of 4 or 5 vertical mattress sutures of 15 to 30 lb. nylon; all sutures are placed before any one is tied, otherwise there is great difficulty in placing the last suture because of the depth of the wound. Suturing is facilitated if the upper hind leg is first returned to its hobble.

All cryptorchidectomy cases are given tetanus antitoxin. There is usually no post-operative malaise. Sutures are removed 1 week after the operation.

Discussion of Surgical Findings

Since November, 1952, 30 cryptorchids have been operated on. Twenty-one were ponies, mostly Welsh, or Welsh crosses, 6 were Thoroughbreds, 2 were riding horses and 1 was a Clydesdale. Sixteen of the 30 were high inguinal and 14 were abdominal cases.

Nine of the abdominal rigs were subjected to flank laparotomy. There were 4 partial abdominal rigs; these and 2 abdominal cases were operated on through the inguinal canal.

There was one death during anaesthetic induction, using sodium pentobarbitone as the sole anaesthetic agent; one pony suffered post-operative bowel prolapse but recovered following prompt replacement of the viscus by way of an inguinal opening through which the whole hand had previously been passed into the abdomen; in 2 inguinal cases there was troublesome, but temporary post-operative sepsis. Scirrhous cord has not been a sequel. All the laparotomy wounds except one healed by first intention. The exception, together with 3 other cases which recovered normally, received no antibiotic either during, or after, the operation. Its wound opened after appearing to have healed and then granulated satisfactorily. It seems certain that the majority of horses subjected to laparo-orchidectomy would recover normally without antibiotic treatment and it is doubtful whether the routine use of antibiotics to prevent the occasional case of superficial wound suppuration is justified. However, fatal post-operative anaerobic wound infection is not unknown in equine practice, and if in a lifetime of surgery one or two cases of malignant oedema can be prevented by the routine use of antibiotics, one must agree that such a course is justified.

Side Incidence of Retention

This was as follows:—

	Left	*Right*	*Both*
Inguinal	4	12	0
Abdominal	4	5	5
Total	8	17	5

These, admittedly low, figures should be contrasted with those of Silbersiepe and Berge (1954) who, out of 229 rigs operated on in Berlin saw little difference in side incidence in inguinal cases but found a 2:1 chance of left-sided retention in abdominal cryptorchids. In 400 cases (inguinal and abdominal numbers not specified), Hobday (1903; 1924) found the side incidence of cryptorchidism to be equal. Wright (1955; 1960) out of 53 rigs noted the left testicle retained in 30 and the right in 23, but there was a marked preponderance of left-sided retention in his abdominal cases. Embryologically, in the horse, it has been observed that in normal descent the right testicle precedes the left and one wonders whether this has any bearing on the greater fallibility of left-sided descent.

Support to this idea is given by Bishop's (1945) observations on the human subject in which the left testicle descends first but the right is more frequently retained.

The causes of Cryptorchidism

In 14 inguinal cases the vaginal sac was too small to allow the testicle to descend fully (Fig. 9); in 8 cases, the spermatic cord was alone, or jointly, a restraining factor. In 9 abdominal cases the testicle

was apparently too large at the time of normal descent to negotiate the inguinal ring, and in 3 the gubernaculum had not contracted. In 3 inguinal cases the retained testicle—the right in all 3—was markedly hypoplastic (Fig. 12). There was 1 case of aplasia of the testis.

It must be conceded that the apparent cause of cryptorchidism at the time of operation is not necessarily the real one which operated during foetal life, but it should be possible to analyse the theoretical causes of cryptorchidism. Normal descent involves a process in which the essential physical components are: (a) the testicle, which must have sufficient freedom of attachment to allow it to be moved from its original, dorsal abdominal, to its final, scrotal, position.

(b) a patent inguinal ring leading to a properly developed tunica vaginalis.

(c) a proper size-relationship between (a) and (b)

(d) sufficient force to move (a) to (b).

The evidence from the partial abdominal rig—which seems to be an equine peculiarity—indicates a disparity between the testicle and inguinal ring, the force of gubernacular contraction pulling only the epididymis into the canal. The deduction may be made that when the normal structural change and resorption of the gubernaculum is occurring, insufficient shrinkage has occurred in the testicle from its previously large foetal dimensions to allow negotiation of the inguinal ring. This might explain the high incidence of cryptorchidism in the equine species.

Presuming that the gubernaculum shortens normally and that the testicle is too large to enter the canal, another outcome is possible and this is contingent on the loose anchorage, particularly in the foetus, of the tunica vaginalis to the scrotum. Namely, when shortening of the gubernaculum occurs the testicle is held up at the ring and the tunica is pulled up out of the canal towards the ring; the whole sac may thus become inverted (Fig. 13). This would explain the absence of an inguinal tunica in many abdominal cryptorchids.

Where the gubernaculum does not shorten, there is presumably no force applied to the testicle to cause it to migrate. The absence of the requisite structural change in the gubernaculum is believed to depend on a faulty hormonal mechanism in which gonadotrophic as well as gonadic hormones play a part. The fact that markedly hypoplastic testicles may descend from the abdomen indicates that intrinsic defects in the gonad are not necessarily inhibitory to descent, and refutes Bland-Sutton's (1923) explanation of cryptorchidism.

Peculiarities of the Retained Testicle

Size. In the uncastrated unilateral cryptorchid the retained testicle, irrespective of its location, is usually smaller than normal, the descended testicle being larger than usual. If, on the other hand, the descended testicle has been removed previously, then the growth of the hidden testicle is accelerated and it may then approach normal size.

Apart from these considerations, the abdominal testicle may become abnormally large due to cystic degeneration, but in the older rigs the retained testicle becomes smaller again due to fibrous tissue replacement of the interstitial tissue. There is no knowledge of the retained equine testicle being subject to malignant disease as in man, but of course, it is unusual for a cryptorchid horse to remain uncastrated beyond 5 or 6 years. Although teratoma formation is well-known in the retained equine testicle, no case occurred in the present series.

Histology. It is established that the retained abdominal testicle of the adult is incapable of spermatogenesis. Its seminiferous tubules are of small diameter and they are lined by a single layer of spermatogonia and Sertoli cells. There is a correspondingly large proportion of interstitial tissue (Fig. 14).

The potential fertility of the inguinal rig has not previously been commented on. The studies made here have shown that the inguinal testicle is also aspermic and that its tubes too are lined only by one layer of spermatogonia but that occasionally there may be a second layer of primary spermatocytes (Figs. 15 and 16).

Acknowledgments.—It is a pleasure to record the help given by the Head of the Department, Professor C. Formston, F.R.C.V.S., whose tuition in surgical matters has been invaluable. Much credit is due to Messrs. W. L. King and P. Henfrey for technical assistance. Mr. E. F. Lewis, M.R.C.V.S., very kindly provided the photographs in Figs. 7, 10 and 12.

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TRIBUTE TO PROFESSOR LEIPER

On his eightieth birthday, Professor Robert T. Leiper, Professor Emeritus of Helminthology in the University of London, was honoured at the London School of Hygiene and Tropical Medicine. He received a *Festschrift* published by the *Journal of Helminthology*, which he founded and edited for many years, and the Bernard-Nocht medal of the Hamburg Tropeninstitut for his outstanding merits in the field of tropical medicine.

The *Festschrift* carries 137 signatures of his admirers gathered from many parts of the world.

The Activity of Bephenium Hydroxynaphthoate Against Hookworms in the Dog

BY

DEIRDRE A. RAWES

Wellcome Veterinary Research Station, Frant, Sussex

SUMMARY.—Bephenium hydroxynaphthoate has been shown to be highly active against Ancylostoma caninum *and* Uncinaria stenocephala *in dogs. The minimum effective dose level was* 50 *mg. base per kg. morning and evening; a single dose of* 100 *mg. base per kg. was much less efficient.*

No toxicity was observed but vomition occurred in a number of cases.

Introduction

THE hookworms *Ancylostoma caninum* and *Uncinaria stenocephala* are a cause of disease in dogs, the former occurring in the tropics and subtropics, the latter in more temperate regions. The related species *Ancylostoma duodenale* and *Necator americanus* are parasitic in man and create a great problem in the warmer areas of the world. The dog hookworms are, therefore, of great value in testing anthelmintics, not only in preparation for their use in the treatment of dogs themselves but also as a preliminary to their trial in man.

A new series of anthelmintics has been reported as showing activity against a large number of nematodes parasitic in laboratory and domestic animals (Copp *et al.*, 1958). Several salts of a member of this series, bephenium, have been shown to be highly active against *Nematodirus* spp. and other trichostrongylid nematodes in lambs, the most efficient being the hydroxynaphthoate (Formula I), a practically insoluble salt (Rawes & Scarnell, 1959).

Method

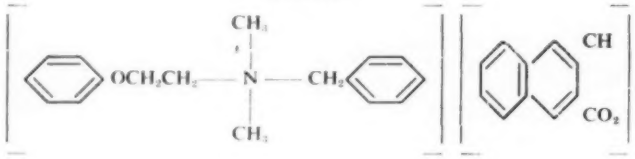
The first observations were made on dogs artificially infected with *A. caninum;* this being the most pathogenic species, was chosen as the main test organism throughout this work. Later, some dogs experimentally infected with *U. stenocephala* were included, as this species occurs in this country and is more closely related to *N. americanus* in man.

Material for infective purposes was obtained by mixing faeces from a dog carrying a pure *A. caninum* or *U. stenocephala* infestation with granular charcoal, and half filling culture dishes which were then placed in the incubator at 28° C. After 7 days the contents of the dishes were emptied into a Baermann apparatus and the infective larvae run off and stored in a cool, dark place.

Dogs of medium size and mixed parentage were used as test animals. Larvae were administered *per os* in gelatine capsules, the number ranged from 500 to 2,000 depending on the age of the animal and the number of infestations it had received.

The drug under test was administered 3 to 4 weeks later when faecal egg counts indicated that the majority of the worms had reached full maturity. All the faeces passed for 72 hours after treatment were collected and washed through a 44 mesh sieve. The retained material was examined in small quantities in a glass dish on a black background and all worms counted and identified. A count of the hookworms remaining after treatment was obtained either

FIG. 1
FORMULA I



Initial testing of the bephenium salts in dogs was carried out in the United States and results indicated a high level of efficiency against *A. caninum* (Burrows, 1958). Following on this and on the work reported below, several salts of bephenium were examined in man, bephenium hydroxynaphthoate being found to be highly efficient and free of side-effects (Goodwin *et al.*, 1958).

In the course of this work the hydroxynaphthoate was soon established as the salt of choice, and therefore only results obtained with bephenium hydroxynaphthoate are recorded in this paper.

by slaughtering the dogs and washing the contents of the small intestine through a 44 mesh sieve, or by dosing the dogs with other anthelmintics and collecting all worms passed, this procedure being repeated until faecal egg counts showed the animals to be completely clear of the parasite. Following the latter method the dogs were re-infested and used in further experiments.

The drug was administered orally in several ways: in gelatine capsules, as tablets sugar-coated or plain, as a syrup suspension and by stomach tube. In the preliminary work a single dose was given in the

morning following fasting overnight, food being offered 2 hours after the dose. Later 2 doses were administered, one in the morning after fasting, food being offered 2 hours later, and the second dose 4 hours after that. In order to facilitate comparison of the efficiencies of different salts of bephenium all doses were calculated on the amount of bephenium base present in the salt. In the case of bephenium hydroxynaphthoate 173 parts of salt contain 100 parts of base.

Results

First tests were carried out in dogs of 9 months old experimentally infected with *A. caninum*. Bephenium hydroxynaphthoate was administered in gelatine capsules and by stomach tube in single doses of 60 mg. base per kg. and 100 mg. base per kg. live-weight respectively. Results are shown in Table I. Clearances were low and no increase in efficiency

TABLE I
MEAN PERCENTAGE CLEARANCES OF *A. caninum* FOLLOWING THE ADMINISTRATION OF SINGLE DOSES OF BEPHENIUM HYDROXYNAPHTHOATE TO EXPERIMENTALLY INFECTED DOGS

Number of dogs	Dose level	Method of administration	Mean number worms passed	Mean per cent. clearance
3	60 mg. base per kg.	Gelatine capsules	376	46
3	100 „ „	Stomach tube	60	44

was observed when the drug was delivered in suspension directly into the stomach even though the dose levels were higher.

Dogs of a year old which had been used in previous tests, cleared and re-infected, were used in the next experiment to determine the relative activity of single and divided doses of bephenium hydroxynaphthoate against *A. caninum*. Single doses of 50 mg. base per kg. and 2 doses of 100 mg. base per kg., 50 mg. base per kg. and 25 mg. base per kg. administered on the same day were given in the form of tablets. Results are shown in Table II. These results, together with those obtained in the previous experiment demonstrate

TABLE II
MEAN PERCENTAGE CLEARANCES OF *A. caninum* FROM EXPERIMENTALLY INFECTED DOGS WHICH RECEIVED SINGLE AND DOUBLE DOSES OF BEPHENIUM HYDROXYNAPHTHOATE

Number of dogs	Dose level	Method of administration	Mean number worms passed	Mean per cent. clearance
2	50 mg. base per kg. (single dose)	Tablets	50	36
2	100 mg. base per kg. a.m. and p.m.	„	137	92
2	50 mg. base per kg. a.m. and p.m.	„	218	93
2	25 mg. base per kg. a.m. and p.m.	„	212	87

that there is an appreciable increase in the efficiency of bephenium hydroxynaphthoate when the dose is divided and given twice in one day instead of as a single administration. The optimum dose level appears to be 50 mg. base per kg. morning and evening.

This effect was demonstrated next in dogs of a year old experimentally infected with *U. stenocephala*. Bephenium hydroxynaphthoate in single doses of 100 mg. base per kg. and 50 mg. base per kg. and in 2 doses of 50 mg. base per kg. were given as tablets. Results are shown in Table III. The complete clearance of this hookworm by 50 mg. base per kg. morning and evening is in marked contrast with the 65 per cent. clearance obtained when the same amount of material was administered as a single dose.

TABLE III
MEAN PERCENTAGE CLEARANCES OF *U. stenocephala* from EXPERIMENTALLY INFECTED DOGS FOLLOWING TREATMENT WITH BEPHENIUM HYDROXYNAPHTHOATE

Number of dogs	Dose level	Method of administration	Mean number worms passed	Mean per cent. clearance
3	50 mg. base per kg. (single dose)	Tablets	51	76
3	100 mg. base per kg. (single dose)	„	35	65
3	50 mg. base per kg. a.m. and p.m.	„	338	100

To confirm the optimum dose level and to determine the best method of administration several tests were carried out using animals ranging from 6 weeks to 1 year old artificially infected with *A. caninum*. Results are shown in Table IV. From these it appears that of the presentations of the drug used, none has any appreciable effect on the efficiency. The minimum effective dose level was confirmed at 50 mg. base per kg.

TABLE IV
MEAN PERCENTAGE CLEARANCES OF *A. caninum* FROM EXPERIMENTALLY INFECTED DOGS FOLLOWING THE ADMINISTRATION OF BEPHENIUM HYDROXYNAPHTHOATE

Number of dogs	Dose level	Method of administration	Mean number worms passed	Mean per cent. clearance
2	50 mg. base per kg. a.m. and p.m.	Tablets	12	96
2	50 mg. base per kg. a.m. and p.m.	Compression coated tablets	48	99
1	50 mg. base per kg. a.m. and p.m.	Gelatine capsules	64	96
3	44 mg. base per kg. a.m. and p.m.	„ „	135	89
2	44 mg. base per kg. a.m. and p.m.	Syrup suspension	20	73
3	25 mg. base per kg. a.m. and p.m.	Tablets	17	37
3	25 mg. base per kg. a.m. and p.m.	Compression coated tablets	16	61
5	22 mg. base per kg. a.m. and p.m.	Gelatine capsules	118	73
2	22 mg. base per kg.	Syrup suspension	31	61

The occurrence of vomition was recorded throughout this work and a number of other experiments

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Israel Turkey Meningo-encephalitis Virus

BY

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SUMMARY.—The turkey meningo-encephalomyelitis virus of Komarov and Kalmar (1960) *has been shown to fall into the Group B of arthropod-borne viruses. Evidence is presented for considering this virus to be a new and distinct member of the group.*

KOMAROV and Kalmar (1960) described the isolation of a virus responsible for an outbreak of meningo-encephalitis in domestic turkeys and gave reasons for believing that the agent was spread by the bites of mosquitoes. This paper describes the results of some studies carried out with the virus which indicate that it falls into the Group B of the arthropod-borne viruses in Casals's serological classification (Casals & Brown, 1954; Casals, 1957).

Materials and Methods

Virus, in the form of 28th mouse brain passage material, was received from Dr. Komarov. This material was inoculated into 3-day-old mice by the intracerebral route. Stock virus was prepared from the brains of mice sick on the third day following inoculation, and a 10 per cent. suspension of 29th passage virus in 10 per cent. calf serum in saline was stored in capillary tubes at −70° C.

Haemagglutination tests were carried out with an antigen prepared by Arcton extraction of infected suckling mouse brains (Porterfield & Rowe, 1960). Haemagglutination-inhibition tests followed the general techniques of Clarke and Casals (1958) with minor modifications.

Tissue culture tests were carried out using chick fibroblast cultures under the conditions of the plaque and plaque inhibition techniques (Porterfield, 1960).

Antisera were prepared in rabbits by the intravenous inoculation of infected mouse brain suspension.

Results

An antigen prepared from the brains of infected suckling mice agglutinated goose erythrocytes over

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The Activity of Bephenium Hydroxynaphthoate Against Hookworms in the Dog.—*Concluded.*

were carried out specifically to measure its incidence. There was no vomition following doses of 25 mg. base per kg. but above that dose it was frequent, and occurred more often when given shortly before or after feeding than when administered during a period of fasting. Vomition also occurred more frequently following the administration of the drug as tablets than when given in gelatine capsules.

Discussion

Anthelmintics at present in use in the treatment of hookworm infestation in the dog are unsatisfactory in that efficiency is usually only moderate, and where anaemia is severe the drugs may aggravate rather than improve the condition.

Seneviratna (1960) has shown bephenium chloride to be of value in the treatment of severe ancylostomiasis in dogs with concurrent infections where other anthelmintics are contra-indicated. The efficiency of bephenium hydroxynaphthoate has been found by us to be as high as that of the chloride and has advantages over it in that it is not toxic and is a more easily handled material, the chloride being deliquescent.

The incidence of vomition following the minimum effective dose of bephenium hydroxynaphthoate, 50 mg. base per kg. morning and evening, was fairly high however, which could be a disadvantage in general use. The administration of the chloride at the minimum effective dose level resulted in a similar frequency of vomition.

Vomition was negligible at 25 mg. base per kg. bephenium hydroxynaphthoate given twice in one day, but although Burrows (1958) has reported a high clearance with single doses of 20 mg. salt (11.5 mg. base) per kg., our work in experimentally infected animals and that of Brown (1959) and Nestel (1960) in naturally infested dogs has shown 25 mg. base per kg. to be quite inadequate for animals carrying burdens sufficient to cause disease.

The incidence of vomition following the use of bephenium hydroxynaphthoate has prompted further testing in an attempt to find a drug of similar efficiency in which side-effects are negligible. Results of this work are to be reported shortly.

Acknowledgments.—The author wishes to thank all those associated with this work, especially Mr. S. L. Hignett, Dr. P. A. Clapham, Dr. F. C. Copp, Dr. O. D. Standen, Mr. D. Stephenson, Miss V. Merry, Miss G. Wrapson and Mr. L. C. Prendergast.

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the range of *p*H from 6.2 to 6.6, the maximum titre of 1:640 was obtained at *p*H 6.4, the cells being allowed to settle at bench temperature. Haemagglutination-inhibition tests were next set up using a variety of antisera prepared in rabbits with the results shown in Table I. None of 5 Group A

TABLE I
RESULTS OF HAEMAGGLUTINATION-INHIBITION TESTS CARRIED OUT WITH TURKEY VIRUS ANTIGEN AND A NUMBER OF STANDARD ANTISERA

	Virus	H.A.I. titre	Homologous H.A.I. titre
	Eastern Equine Encephalitis	<10	640
	Western " "	<10	1,280
Group A.	Sindbis	<10	N.T.
	Semliki Forest	<10	1,280
	Mayaro	<10	N.T.
	West Nile	320	1,280
	Yellow Fever	40	640
Group B.	Zika	160	640
	Japanese B	160	640
	Louping Ill	80	160
Other groups	Bunyamwera	<10	>320
	Ilesha	<10	N.T.
	Bwamba	<10	N.T.

N.T. = not tested.

antisera inhibited agglutination, whereas all 5 of the Group B sera examined inhibited the turkey virus antigen, the highest titre being that given by West Nile immune serum. Serial bleedings from a rabbit inoculated with the turkey virus were next tested against a number of different haemagglutinins with the results given in Table II. Antibodies inhibiting the agglutination of red blood cells by homologous turkey virus antigen were present on the seventh day, rose in titre during the next 7 days and then fell again. A similar, but less strong, reaction was seen with the 3 other Group B antigens tested, but there was no evidence of antibodies affecting either of 2 Group A antigens.

TABLE II
RESULTS OF HAEMAGGLUTINATION-INHIBITION TESTS CARRIED OUT ON SERIAL BLEEDINGS TAKEN FROM A RABBIT WHICH HAD BEEN INOCULATED WITH ISRAEL TURKEY MENINGO-ENCEPHALOMYELITIS VIRUS

H.A.I. TITRE AGAINST 8 H.A.D. OF DIFFERENT ANTIGENS

	Group A.		Group B.			
	W.E.E.	S.F.V.	West Nile	Zika	Uganda S.	Turkey virus
Day 0	<10	<10	<10	<10	<10	<10
" 7	<10	<10	20	20	10	40
" 14	<10	<10	80	40	40	160
" 28	<10	<10	20	20	20	80

These results strongly suggest that the turkey virus is a member of the serological Group B of the arthropod-borne viruses, but they do not provide data for more specific identification. This was provided on the basis of tissue culture studies using the plaque inhibition test.

Preliminary tests showed that well defined plaques were produced in chick fibroblast monolayers on the third day after inoculation, the titre of the stock virus preparation being approximately 2×10^7 plaque-forming units per ml. Clear zones of plaque inhibition developed around beads containing homologous turkey virus immune serum, but antisera against 25 other viruses, including 12 Group B agents, failed to have any effect upon turkey virus plaques, although all the sera used had been found to be active in plaque inhibition tests carried out with the respective homologous virus (see Table III). Reciprocal tests carried out with West Nile, Uganda S, Ilheus, Zika and louping ill viruses failed to show any inhibition of plaque formation around beads containing a potent turkey virus immune serum.

TABLE III
PLAQUE INHIBITION TESTS WITH ISRAEL TURKEY MENINGO-ENCEPHALITIS VIRUS

Antiserum	10^{-3}	10^{-4}
Chikungunya	0*	0
Eastern equine encephalitis	0	0
Mayaro	0	0
Middelburg	0	0
O'Nyong-nyong	0	0
Semliki Forest	0	0
Sindbis	0	0
Uruma	0	0
Western equine encephalitis	0	0
Dengue type I	0	0
Ilheus	0	0
Japanese B	0	0
Ntaya	0	0
Spondweni	0	0
Turkey meningo-encephalitis	17	18
Uganda S....	0	0
West Nile	0	0
Yellow fever	0	0
Zika	0	0
Kyasanur Forest	0	0
Langat (TP64)	0	0
Louping ill	0	0
Bunyamwera	0	0
Ilesha	0	0
Bwamba	0	0
Encephalomyocarditis	0	0
Virus dose plaque forming units ...	16,000	1,600

* Diameter of zone of inhibition in mm.

Discussion.

These results demonstrate that although the Israel turkey meningo-encephalitis virus falls clearly into the Group B arthropod-borne viruses on the basis of haemagglutination inhibition tests, it is antigenically distinct from at least 12 of the Group B viruses on the basis of neutralisation tests carried out by the plaque inhibition test. There are now known to be at least 20 different viruses within the Group B, and further identification was impossible with the viruses and antisera then available in London. The virus, and a sample of immune serum, were therefore forwarded to Dr. M. Theiler at the

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A Case of Scrapie in an Uninoculated Goat—A Natural Occurrence or a Contact Infection?

BY

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SUMMARY.—A case of scrapie in an uninoculated adult goat is described. Diagnosis was confirmed by histological examination.

Introduction

CHELLE (1942) recorded the clinical picture of a case of scrapie which was of natural occurrence in a goat. He considered that the disease had not previously been reported in that species because of the small number of goats likely to be exposed to infection and the long incubation period of the condition. He mentioned that 2 similar cases had been reported to him and that these animals, like his own case, had been kept with scrapie sheep. There are no other reports of the natural occurrence of scrapie among goats to the best of our knowledge. The purpose of the present communication is to report the occurrence of scrapie in a goat which was used as an uninoculated control in a biological transmission experiment at Moredun Institute.

History

The animal (LSB 7304) was bought from a dealer and was 3 years old when she came to Moredun on December 11th, 1959. She had two previous owners before this time. Although it is difficult to be positive it is unlikely that she had direct contact with scrapie sheep at any stage but, for the year prior to her coming to Moredun, she grazed a pasture which a dealer uses for sheep from time to time. We have only been able to trace 1 goat with which she was previously in contact. The animal (LSB 7304) was kept separate from other goats for a few weeks after her arrival at Moredun, and then, together with an uninoculated hermaphrodite, put in the same pen as a group of inoculated goats.

The inoculated animals had been housed together in one pen in a covered sheep house from the time of inoculation and were of 3 groups:—

Group A comprised 4 goats which had been inoculated intracerebrally with a suspension of 5th passage goat brain on December 8th, 1959.

Group B comprised 3 goats which had been injected intravenously with the same material as that used for group A, on January 7th, 1960.

Group C comprised 4 goats which had been inoculated intracerebrally with a suspension of 5th

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Israel Turkey Meningo-encephalitis Virus.—*Concluded.*

Rockefeller Foundation Virus Laboratory in New York, where further tests were carried out by Dr. J. Casals. The results of these tests confirmed that the virus fell within the serological Group B and indicated that it was a new and distinct agent.

These studies emphasise the value of the haemagglutination and haemagglutination-inhibition tests for the preliminary grouping of arthropod-borne viruses. They also show the value of the plaque inhibition test for precise identification. Evidence that the turkey virus was different from 7 other Group B viruses was provided in a single experiment using less than 0.1 ml. volumes of serum, with a result which was clearly readable on the fourth day. To have obtained the same amount of information by the use of standard mouse neutralisation methods would have required many hundreds, if not thousands of mice, and much greater quantities of immune sera.

The virus was isolated from an area in Israel where West Nile virus infections are common. The findings of the original authors, that the turkey virus was not West Nile virus has been confirmed, although both are members of the same serological Group B. The occurrence of 2 distinct Group B viruses in one geographical area is by no means unknown; yellow fever and Uganda S in East Africa, yellow fever and Zika in West and East Africa, dengue and Japanese B encephalitis in the Far East are obvious examples. Yet it is tempting to speculate, as already done elsewhere (Porterfield, 1960b) that the turkey meningo-encephalitis virus may have originated as a mutant of West Nile virus which showed unusual pathogenicity for a new host, in this case the turkey, and by a series of rapid passages in turkeys underwent an antigenic change which is sufficient for the descendants to be considered different from the original West Nile virus.

Acknowledgments.—The author is indebted to Dr. M. Theiler and Dr. J. Casals for permission to refer to results of tests carried out in the Rockefeller Foundation Laboratories in New York; also to Mrs. L. Bevington for valued technical assistance.

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passage goat spleen and lymph nodes on December 8th, 1959.

These groups form part of a larger experiment, the details of which will be reported at a later date.

Results

The first signs of scrapie were noted among animals of group A in July, 1960. All 4 goats in this group had developed signs and were sacrificed by September 23rd, 1960.

No cases of scrapie have occurred in group B to date.

Two cases of scrapie have occurred in group C.

The outstanding clinical feature, in the first animal in group A to develop signs, was a slowly developing inco-ordination. This animal tended to stand with the hind legs drawn forward and the withers low. It was less active than the other goats in the pen and often stood with its head cocked sideways as if staring at a fixed object. It became progressively duller and the inco-ordination became more obvious, particularly in the hind quarters, until finally it appeared to have difficulty in maintaining its balance even when stationary. At no stage was there evidence of hyperexcitability or skin irritation.

By contrast the remaining 5 cases in groups A and C exhibited quite a different clinical picture. The outstanding feature in these cases was cutaneous pruritus. There was evidence of intense itching and the animals scratched vigorously with their hind legs and/or horns so that the appropriate areas became denuded of hair. This was most obvious over the withers and extending downwards from that point over the anterior aspect of the shoulders and base of the neck. Two animals inflicted obvious damage at the base of the horns and around the eyes. One horned animal denuded itself of hair over the rump. In 2 cases scratching was so violent as to break the skin over the withers and shoulders. Some degree of hyper-excitability and inco-ordination developed in 1 case before slaughter.

In July, 1960, the uninoculated nanny (LSB 7304) was seen to be scratching in a similar manner and by the middle of August was scraping consistently and had broken the skin over the withers producing haemorrhage and subsequent scab formation (see Figs. 1 and 2). At this stage she exhibited an abnormal posture with the rump held high and the tail cocked (see Fig. 1) and slight inco-ordination was present. She was sacrificed on August 23rd, 1960.

FIG. 1

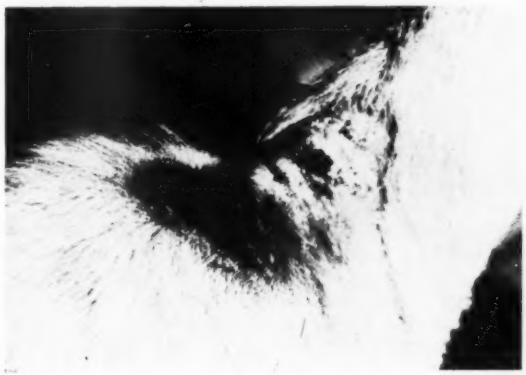

FIG. 2

Pathological examination of LSB 7304. There was no evidence of ectoparasitic infestation. The only gross abnormality detected at *post-mortem* examination was in the skin.

Examination of histological sections of the affected areas of skin showed the epidermis to be of about 3 times normal thickness with small finger-like processes projecting into the dermis and hyperkeratosis of the surface. No cellular infiltration was present in the dermis and there was no evidence of parasitic infestation. Histological examination of the brain revealed changes similar to those present in goats in which scrapie has been induced by inoculation.

Discussion

It is of special interest that pruritus was the outstanding clinical feature for Chelle's natural case was also of this type, whereas his experimentally-induced cases in goats showed mainly locomotor disturbances.

There would appear to be two possible explanations of the occurrence of scrapie in our uninoculated goat. The first is that the disease was of natural occurrence and the fact that the clinical picture was similar to that in 5 inoculated goats in the same pen was a mere coincidence. The second possibility is that the disease has arisen as a result of contact with the inoculated goats. If the second alternative is the correct explanation, then this has taken place within a remarkably short time for previous attempts to spread scrapie by direct contact between goats clinically affected with scrapie and non-inoculated goats failed to produce any cases in 28 animals kept in a scrapie environment for periods of 24 to 34 months (Pattison & Millson, 1960). In addition, the period for which this animal was in contact with inoculated goats before she showed signs (6 to 7

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The Action of Hydrochlorothiazide in the Turkey

BY

A. H. SYKES

The Physiological Laboratory,
University of Liverpool

SUMMARY.—Hydrochlorothiazide has a powerful diuretic action in the turkey. There is a marked rise in the minute volume, the excretion of sodium, potassium and chloride and, to a lesser extent, of uric acid. The pH becomes alkaline. The effects persist for at least 5 hours after a single dose of 25 mg.

IT has been reported by Swarbrick (1960) that the diuretic hydrochlorothiazide has been successful in the treatment of an outbreak of a new disease of young turkeys which has been the subject of correspondence in this journal recently.

Hydrochlorothiazide belongs to the sulphonamyl group of compounds which includes the carbonic anhydrase inhibitors such as acetazolamide. These and other diuretics are at present being examined for their effect on urine composition in the fowl, and, in view of Swarbrick's report, the opportunity was taken to make a preliminary study of the action of hydrochlorothiazide in the turkey.

Methods

Three Beltsville White turkeys, aged 20 weeks and weighing 3 to 4 kg., were kindly provided by Mr. M. J. Clarkson, M.V.SC. They were lightly anaesthetised with pentobarbital intravenously, followed by sodium phenobarbitone (100 mg. per kg.) intramuscularly, and catheters were attached to the orifices of the ureters in the manner described by Lindahl & Sperber (1956) for the fowl.

A control sample of urine was collected for 60 minutes without the use of any diuretic. This resting urine flow was at the rate of 0.08, 0.09 and 0.07 ml. per minute for birds A, B and C respectively. Fifty mg. hydrochlorothiazide* were then injected into the pectoral muscle of A and B and 25 mg. intravenously into C, and samples of urine collected at 20-minute intervals. The hydrochlorothiazide preparation was not diluted before use.

The *p*H of the urine was measured directly by *p*H meter; uric acid was determined by the method of Feichtmeir and Wrenn (1955); chloride by the method of Schales and Schales (1941) with prior acidification of the alkaline urine with a few drops of O.IN nitric acid; sodium and potassium were determined by flame photometry with an EEL instrument.

Results

Essentially the same results were observed in all 3 experiments but the response was slow and more persistent in birds A and B than in bird C. The results for the latter are given in Fig. 1. It was hoped to follow the complete reaction of the bird from the time that the diuretic was given until the return of normal conditions, but this was not possible. Turkey A was observed for 6 hours, turkey B for 9 hours and turkey C for 5 hours, and the urine composition was substantially different from normal when the experiment was discontinued.

The effect of the drug on the various factors was as follows:—

Minute volume of urine. This rose immediately in turkey C to nearly 5 times the resting flow and remained fairly high throughout the experiment. In A the flow rose to nearly four times normal in 3½ hours; turkey B was unusual in that an immediate response of from 0.09 to 0.22 ml. per min. was followed 4 hours later by a very marked polyuria reaching nearly 0.9 ml. per min. This may have been the result of delayed absorption from the pectoral muscle, although, as shown by other criteria, *i.e.* *p*H and elecrolyte excretion, enough of the hydrochlorothiazide had been absorbed to produce an immediate effect.

In general the diuretic response was not as intense as can be produced with an osmotic diuretic such as mannitol. With the latter, flows well over 1 ml. per min. are readily obtained and at this rate the urine is usually a clear solution without deposits of uric acid.

pH. From resting values of 5.5, 5.3 and 5.8 the *p*H rose to about 7.0 and remained there for the duration of the experiment.

Uric acid. The rate of excretion showed a tendency to increase especially in birds A and B in which the maximum rate coincided with the maximum polyuria. From unpublished work on the fowl it appears that there is a direct positive correlation between urine flow, no matter how it is produced, and uric acid excretion. There is therefore no need to postulate a specific response to hydrochlorothiazide by the turkey in this respect.

* Vetidrex: Ciba Laboratories Ltd.

A Case of Scrapie in an Uninoculated Goat.—*Concluded.*

months) is not longer than would be expected if the disease had been induced under optimum conditions (*i.e.* scrapie goat brain suspension inoculated intracerebrally).

Acknowledgments.—The authors would like to thank Dr. I. Zlotnik for his histological examination of the C.N.S. and Dr. D. I. Nisbet for his examination of the skin.

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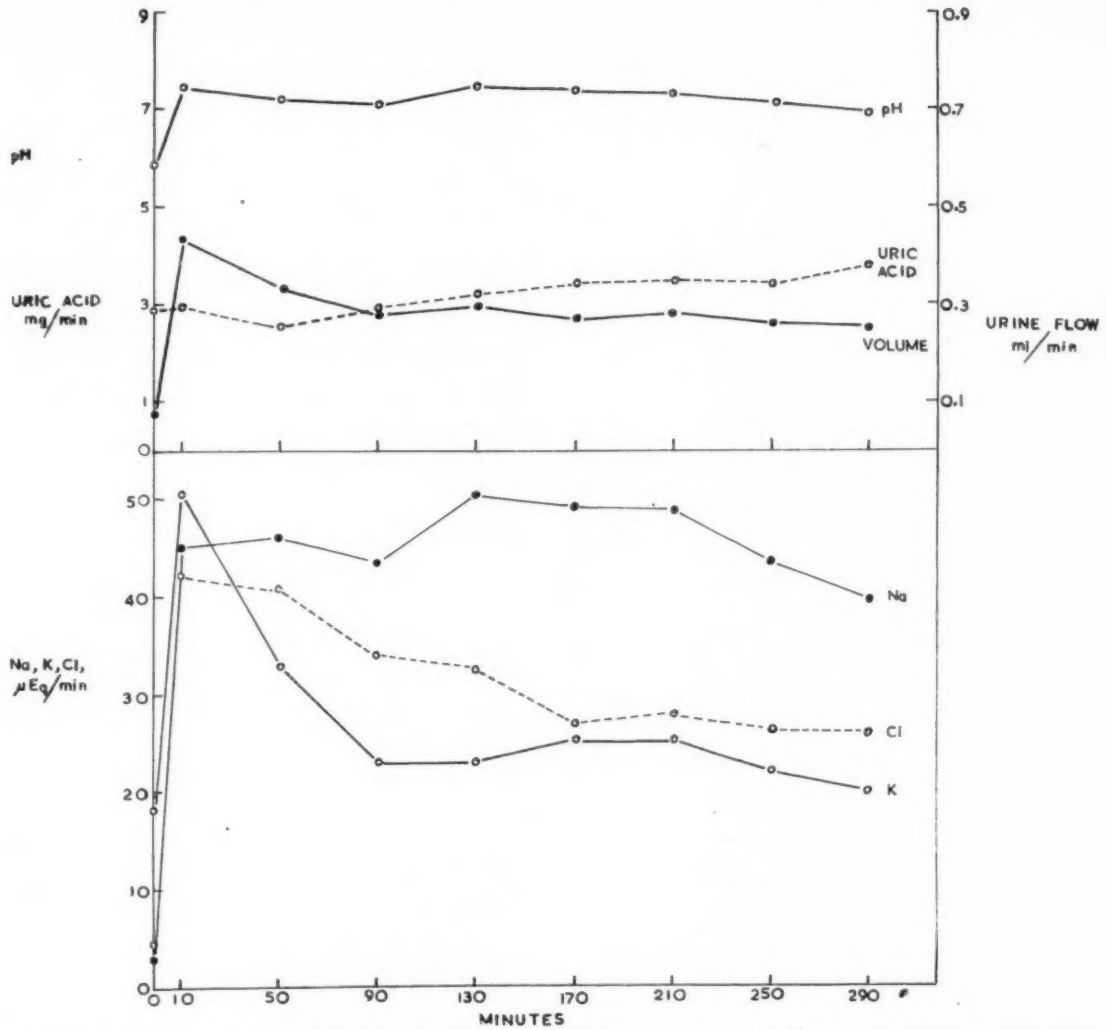

FIG. 1.—The effect of 25 mg. hydrochlorothiazide (intravenously) on the composition of the urine of turkey C (3.2 kg.).

Electrolytes. The resting excretion of potassium was greater than that of sodium and the immediate response to hydrochlorothiazide was a marked rise in the potassium output.

In experiment C the excretion of sodium also increased immediately while in the other experiments it took longer to reach its maximum rate. But, as in Fig. 1, the excretion of sodium eventually exceeded that of potassium and remained high throughout, while the potassium tended to fall. The output of both sodium and potassium was still well above normal at the end.

The excretion of chloride followed that of sodium but, as shown in Fig. 1 the absolute rate was intermediate between sodium and potassium.

Since the rate of excretion of sodium and potassium together was greater than that of chloride it follows that the excretion of some other anion, possibly bicarbonate, also must have increased.

These results show that hydrochlorothiazide is a very potent diuretic in the turkey and one that is remarkably safe to use. No side effects were noticed even after fairly rapid intravenous injection. This contrasts strongly with acetazolamide which, in preliminary experiments with turkeys and fowls, has proved fatal in doses greater than 5 mg. per kg. and which has far less diuretic action.

Until more is known about the disease in turkeys, which prompted this work, it cannot be decided whether hydrochlorothiazide therapy is rational or empirical. It does not automatically follow that its value resides in its diuretic properties; this can only be decided after further investigation.

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Current Literature

ABSTRACTS

Coagulase Positive α-β Toxigenic Udder Staphylococci. HØGH, P. (1960). *Nord. VetMed.* **12.** 588.

11·4 per cent. of 674 strains of pathogenic staphylococci from milk samples were penicillin resistant. When they were classified according to their growth on crystal violet agar it was observed that the strains which produced violet colonies also tended to be penicillin resistant. In 1 herd of 110 milk cows (not included in the 674 samples above) in which penicillin had been used regularly to control streptococcal mastitis, 87·3 per cent. of the staphylococci were penicillin resistant. In another herd of 150 cows in which penicillin was used only to treat acute cases of mastitis, all staphylococci which were isolated were penicillin sensitive.

Sensitivity to chloromycetin and novobiocin was also surveyed. All strains of staphylococci examined were sensitive to these 2 antibiotics. H. B.

The Effect of Feeding Pigs on Food Naturally Contaminated with *Salmonellae*. SMITH, H. WILLIAMS (1960). *J. Hyg.* **58.** 381.

Pigs, initially considered to be free of salmonella infection, were fed on food naturally contaminated with *salmonellae*, and then killed at varying times after the commencement of the experiment. None of the pigs showed any signs of ill-health and no pathological lesions were observed in them when they were killed. *Salmonellae* were found in the mesenteric lymph nodes of some of them but not in any other organ or in the musculature. The longer the pigs were fed on the contaminated food the more likely were their mesenteric lymph nodes to be infected.

Salmonellae were occasionally isolated from the faeces of the pigs but none of the pigs became permanent faecal excretors of these organisms.

The withdrawal of the contaminated food usually resulted in the pigs becoming free of *salmonellae*.

The Examination of Milk for the Presence of *Mycobacterium johnei*. SMITH, H. WILLIAMS (1960). *J. Path. Bact.* **80.** 440.

Mycobacterium johnei was not isolated from 52 herd samples of milk collected at different times from farms on which Johne's disease was a serious problem. It was isolated from the milk of only 1 of 20 cows suffering from the clinical disease.

H. W. S.

The Action of Hydrochlorothiazide in the Turkey.—*Concluded.*

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Genetic Aspects of Hip Dysplasia in Dogs. SNAVELY, J. G. (1959). *J. Amer. vet. med. Ass.* **135.** 201.

Pure-bred German Shepherd Dogs were bred experimentally in order to study whether or not hip dysplasia is genetically transmitted. As routine, the puppies were X-rayed at 3, 6, and 12 months irrespective of clinical evidence of hip disease. In a litter of 7 puppies that resulted from the mating of a dysplastic male to a dysplastic female, 1 male and 3 females were dysplastic whereas 3 other males were normal. When the sire of this mating was rebred to one of his dysplastic daughters all 8 of the surviving progeny were dysplastic. The same sire was also bred with a female with no X-ray history but some of whose previous offspring were dysplastic, and this resulted in a litter of 9 of which the 7 that could be followed were dysplastic. A daughter of this mating was bred to her sire, producing 7 offspring of which the 5 that could be followed were dysplastic.

In another instance a normal male was bred to a dysplastic female producing a litter of 6, of which only 1 was afflicted. When a normal female of this generation was bred to another normal dog 1 of a litter of 5 was abnormal.

Three pairs of normal parents were also bred and of the resulting 18 pups, 3 were dysplastic.

Although there was an insufficient number of animals to provide conclusive evidence, the present results suggest that females are more frequently afflicted than males and that their disease is generally more severe. The experiments, however, are thought to have conclusively demonstrated that the disease is genetically conditioned, although it is not possible to describe the precise nature of the genetic component. An important finding is the relatively high incidence of dysplastic pups from radiologically normal parents, since it is on the basis of radiographic examination that it was hoped the disease trait could be eliminated.

L. C. V.

Hereditary Acetabular Dysplasia in German Shepherd Dogs. HENRICSON, B., & OLSSON, S. E. (1959). *J. Amer. vet. Med. Ass.* **135.** 207.

For an accurate assessment of the appearance of the hip joints in the dog pelvic X-rays should be taken in the ventro-dorsal position with the hind limbs flexed and in maximum abduction. Viewed thus the normal acetabulum is a half-circle or a little deeper in shape. Of 471 German Shepherd dogs examined in this way, 295 presented a uniform appearance. In the remainder there were various degrees of uni- or bilateral acetabular shallowness. There seems to be no definite correlation between the degree of acetabular dysplasia and the occurrence of subluxation or luxation. Spur formation on the acetabular rim and femoral head most probably occurs only as a sequel to subluxation.

Evidence of a genetic background for the occurrence of the defect has been obtained by radiographic examination of a number of parents and their progeny.

When 1 or both parents are defective a significantly higher proportion of defective pups results than in matings between normal animals.

Although it has been estimated that about 20 per cent. of German Shepherd dogs exhibit acetabular dysplasia only 14 of some 750 dogs admitted to the Stockholm Veterinary College for various reasons actually showed limb dysfunction due to this condition. It appears that lameness results only when the joint is subluxated or luxated.

The Experimental Infection of Cattle with *Mycobacterium johnei*. II.—Adult Cattle Inoculated Intravenously. RANKIN, J. D. (1961). *J. comp. Path.* **71.** 6.

Five Ayrshire cows, believed never previously to have been exposed to Johne's disease, were injected intravenously with a virulent culture of *Mycobacterium johnei* when they were 3 years old. None of them showed signs of Johne's disease during the following 4 years, nor was *M. johnei* ever cultured from their faeces, which were examined at monthly intervals during that period. After 4 years they were killed and their internal organs examined macroscopically, microscopically, and culturally for Johne's disease and/or the presence of *M. johnei*. Four cows showed no macroscopic or microscopic lesion of Johne's disease in the intestine. Slight microscopical evidence of Johne's disease was found in the ileum of the remaining cow and *M. johnei* was cultured from the tissues of its duodenum, ileum, caecum and rectum. *M. johnei* was isolated from 1 or more lymph nodes of all 5 cows; the retropharyngeal and ileo-caecal were most commonly involved.

The Experimental Infection of Cattle with *Mycobacterium johnei*. III.—Calves Maintained in an Infectious Environment. RANKIN, J. D. (1961). *J. comp. Path.* **71.** 10.

Nine Ayrshire calves born from cows known to be free from Johne's disease were reared continuously with 3 calves that had been injected intravenously with a culture of *Mycobacterium johnei* when they were 1 month old; all 3, as a consequence, died from Johne's disease 2 years after the commencement of the experiment. Three of the 9 calves were 1 week old, 3 1 month old, and 3 6 months old, when they were thus first exposed to infection. The 9 calves were observed for approximately 5 years, when the survivors were killed and examined for evidence of Johne's disease and/or *M. johnei*. Two of the calves first exposed to infection when 1 month old and 2 of those first exposed when 6 months old developed typical clinical Johne's disease. A further 2 calves developed the sub-clinical disease; no evidence of disease was found in the remaining 3 but *M. johnei* was isolated from a small number of their internal organs or lymph nodes. The fact that 2 of the calves exposed at 6 months developed clinical Johne's disease is not in agreement with previous work (Taylor, A. W., 1953. *J. comp. Path.* **63.** 355) in which it was not found possible to infect 6-month-old calves by intravenous injection. It is suggested, however, that the continuous exposure to infection obtained in the present studies may be a more severe test of resistance to infection than is a single injection of *M. johnei*.

The method of infecting calves by continuous exposure to infection is recommended for prophylactic and allied studies. H. W. S.

Studies on Immunity to *Haemonchus contortus* Infection. Vaccination of Sheep Using a Single Dose of X-irradiated Larvae. JARRETT, W. F. H., JENNINGS, F. W., MCINTYRE, W. I. M., MULLIGAN, W., & SHARP, N. C. C. (1959). *Amer. J. vet. Res.* **20.** 527.

Using X-irradiation as a method of attenuation of infective larvae the authors immunised lambs with larvae of *Haemonchus contortus* which had been exposed to varying dosage rates of X-rays. One hundred and seventeen days later the animals were challenged with a dose of normal larvae, and were killed 46 days after challenge. Of the various dosage rates of X-rays the level of between 40,000 and 60,000 roentgens appears to be a satisfaction irradiation level. Lambs dosed with larvae at this irradiation level showed marked inactivation of larvae of the challenge dose and good immunity. This work confirms that of other authors, namely that it is the larval phases of a nematode infection which are responsible for the initiation of the protective immunity and the production of the "functional" antigens. In intestinal nematode infections it would appear that the adult parasite plays very little part in the production of protective immunity.

The Efficacy of Cyanacethydrazide as a Treatment of Lungworm *Dictyocaulus viviparus* (Bloch) Infections in Cattle. SWANSON, L. E., WADE, A. E., SENSEMAN, V. F., & DJAFAR, M. I. (1959). *Amer. J. vet. Res.* **20.** 777.

The authors investigated the efficacy of the drug Cyanacethydrazide* in the treatment of lungworm infection in cattle. A total of 230 cattle were used in experiments which consisted of the treatment of field infections in the laboratory, the treatment of pure infections in the laboratory, and the treatment of field infections under field conditions. The drug was given at the rate of 250 mg. of crystalline drug per 35 lb. bodyweight. Following treatment with the drug all cattle were killed and a complete examination made for the presence of lungworms. The results of the trials indicated that the study did not reveal any significant beneficial effect from treating cattle infected with lungworms with the drug. Statistical analysis revealed no significant decrease in larval output in treated animals, the treatment did not save the lives of animals in the later stages of the disease in the field cases, and the treatment did not alter the gross pathology of the lungs in treated animals. Finally, the weight gains of animals surviving the field trial were in favour of the control animals rather than the treated ones. E. J. S.

* Dictycide.

Divisional News

THE SOCIETY OF PRACTISING VETERINARY SURGEONS

A general meeting of the Society was held at the Wellcome Veterinary Research Station, Frant, nr. Tunbridge Wells, on October 26th, 1960, at 2.30 p.m. The President, Captain R. N. Phillips, took the Chair. Sixteen members and guests were present.

Apologies for absence were received from the following:—

Messrs. J. M. Ingram; G. S. Powley; H. M. Wilson; S. F. J. Hodgman; A. H. Robb, Glasgow; H. A. Crawshaw; F. V. John; H. F. Hebeler; S. Jennings; J. B. Edwards; J. J. Dunlop; J. R. B. Dawson; M. E. I. Searle; J. H. Parsons; A. R. Ayliffe; R. C. Robinson; J. B. White; E. Wilkinson; J. Pasfield; W. B. Singleton, and G. Wyse.

Minutes

The minutes of the general meeting held at Preston, on September 21st, 1960, having been circulated, were signed as correct.

Obituary

Mr. F. H. Jenkins, of Woodhall Spa. The President asked the meeting to stand while the obituary list was read, and went on to say that Mr. Jenkins had been the oldest living member of the Society and had been accorded the distinction of honorary membership.

Elections to Membership

Messrs. W. Corrigall; P. H. Mercer; K. S. Mitchell; J. R. E. Craven; P. D. I. Thomas; P. W. Franks; T. H. Norman; R. R. Henry; J. Forster; T. M. Eaton; R. R. Macrae; H. N. Bateman; A. H. Dawson; L. G. Lawfield; J. Phillips; J. R. Strang; D. J. B. Sutherland; R. J. Low; and R. F. Waterston.

Nominations

Messrs. J. S. J. Lauder; M. T. Greenwood; C. J. T. Ironside; J. R. Baillie; R. S. Cowie; and G. L. Shearer.

The total membership as at October 26th, 1960, was 568.

British Veterinary Association

(a) A letter from the secretary, B.V.A., concerning the institution of refresher courses in poultry disease and management was read.

(b) A letter from the secretary regarding provision of photographs of animals in health and disease was read also.

There was no general correspondence.

Paper read by Miss D. A. Rawes

This was entitled "Parasitic Nematodes of Sheep and Cattle; Some Practical Aspects," and in opening it Miss Rawes outlined the life cycle of the common intestinal nematodes with the aid of large, easily understood diagrams. On the subject of larvae it was pointed out that temperature governed the larval life-span—the time factor was, therefore, very variable. Desiccation was fatal to larvae, but many could live throughout the winter.

Nematodirus larvae could live in the egg from one spring to the next—the larvae might hatch from the eggs early in February or March if there were a warm spell. This might last several weeks, but if followed by a cold spell, larval death would occur without the protection of the egg. Pre-natal infection with Nematodirus did not occur.

The severity of incidence of Nematodirus ranged from April to mid-July, Ostertagia from mid-June to mid-October and Trichostrongyles from September to November.

The main pathological lesion of haemonchosis was anaemia, whilst nematodirosis and trichostrongylosis resulted in mucosal damage with scouring, dehydration, etc.

On the subject of toxin production by nematodes resulting in sudden death, Miss Rawes considered that not enough experimental work had been carried out to express a definite opinion. Her general views on significant egg counts were as follows:—

Nematodirus	10,000 eggs per gramme.
Trichostrongylus axei	" " " "
Cooperia	" " " "
Ostertagia	2,000 eggs per gramme.
Haemonchus contortus	500 eggs per gramme.

A total burden of over 10,000 eggs per gramme was invariably of pathogenic significance irrespective of the individual constituents.

Regarding faecal samples the lecturer stated that individual rather than bulk samples were most satisfactory—rectal sampling giving the most accurate results. For intestinal nematodes 3 g. of faeces was sufficient, whereas for Dictyocaulus 10 g. was required. Faecal consistency was of great significance in the interpretation of egg counts.

No nematodirosis would be likely in lambs if no sheep had grazed the pasture during the previous year. On average 5 to 7 days elapsed from eggs to larvae, and lambs should, therefore, be moved to fresh grazing every 3 days. Miss Rawes added that the feeding of 1 to 1.5 g. phenothiazine per day to ewes would cut down egg-production and thus reduce the incidence in lambs.

The main cross-infection between sheep and cattle appeared to be *Trichostrongylus axei*. Lungworm infestation in sheep was not very important except in the presence of other diseases.

Folfowing Miss Rawes's paper, Mr. G. C. Shearer gave a demonstration of the Phillips oesophageal drenching and bullet guns. Several members tried out the 2 guns on sheep, and those who already possessed such instruments quoted their own experiences with them.

In the discussion which followed it became apparent that nematodirosis did not necessarily occur at the same time of year throughout the country. Miss Rawes considered May to June the danger time for the south-east, but it seemed that on the Welsh borders, and in the Midlands, the peak incidence was often in August and September.

In answer to a question on phenothiazine it became apparent that great importance should be attached to particle size. Miss Rawes recommended routine dosing of ewes with phenothiazine before tupping, one month before and one month after

lambing; the dose in each case should be 30 g.

Several members expressed the view that phenothiazine in pellet form was not as effective as when given as a suspension.

The discussion ranged from intestinal nematodes *via* liver fluke and warbles to virus pneumonia, fog fever and husk. An interesting point that arose from this discussion was the significance, when endeavouring to establish a diagnosis in the living animal, of the high temperature seen in virus pneumonia.

The apparent toxicity of phenothiazine for goats was raised and the advisability of administering clostridial antiserum prior to most interferences in this species was mentioned.

The following members took part in the discussion:—

Messrs. Chipperfield, Hignett, Johnston, Blair-Fish, Pepper, Burke, Oliver, Clark, Brander, Good, Hughes, Swift and Smith.

A vote of thanks to Miss Rawes and Mr. Shearer was proposed by the junior vice-President, Mr. J. B. Johnston.

Other Business

A member drew the attention of the meeting to the possible dangers inherent in the intravenous administration of sulphadimidine to Thoroughbred racehorses.

The President asked Mr. S. L. Hignett to convey the Society's thanks to the Wellcome Foundation for permitting the Society to meet at Frant.

THE SOCIETY FOR THE STUDY OF ANIMAL BREEDING

The ninth Annual General Meeting of the Society was held at the Royal Society of Medicine, 1 Wimpole Street, London, W.1, on Thursday, February 9th, 1961. Thirty-five members were present, and apologies for absence were received from 10 members. The President, Dr. A. W. Stableforth, was in the Chair.

Minutes

The minutes of the October meeting were read and signed.

Matters Arising

There was a discussion on arrangements for future meetings and names were put forward for speakers on sheep diseases for the summer meeting.

It was agreed to postpone the Pig A.I. symposium.

Membership

Messrs. J. W. Simpson and J. W. Stables were elected to ordinary membership and Dr. C. Polge to associate membership.

Report from Council

(a) A letter had been received from the Chairman of the Technical Development Committee of the B.V.A., thanking the Society for the work done in producing the Guide to Pregnancy Diagnosis and Infertility Treatment.

(b) The B.V.A. had referred to the Society a letter from the Royal Agricultural Society of England which had been circulated to exhibitors announcing courses in A.I. instruction for herdsmen.

It was agreed to recommend that the Society's reply should be that there would be no objection to such tuition being given provided that the trainees were made fully aware of the 1957 A.I. Regulations of the Ministry of Agriculture, and that it should be pointed out what limitations the Regulations imposed on their activities.

(c) Mr. D. L. Stewart reported on B.V.A. Council affairs of interest to the Society. He reported that a sub-committee of the Technical Development Committee had been set up to review B.V.A. policy on brucella control. Another sub-committee was still working on the draft of a policy statement on blood grouping. It had been decided that the Guide to Pregnancy Diagnosis and Infertility Treatment should be available free on request to members of the B.V.A. for 3 months from the date of issue.

The Report was adopted.

Secretary's Report

The Secretary reported that 3 meetings had been held during the year, including a 2-day meeting in Dublin. The average attendance had been 38 members and 10 visitors. Papers had been given on a variety of subjects by Professor Amoroso, Dr. H. Boyd, Dr. H. Read, Mr. J. S. M. Cosgrove, Dr. Hans Larsen, Mr. W. K. Hunter, Dr. H. J. Cembrowicz, and Professor C. W. Emmens.

During the year a booklet had been completed for the B.V.A., and the Constitution had been amended to allow senior membership.

Treasurer's Report

A balance sheet had been circulated; Mr. F. A. Edgson reported a balance of £14. During the year £21 5s. 0d. had been forwarded to the Victoria Veterinary Benevolent Fund.

Election of Officers

The following were elected for the year 1961/62:—President: Mr. G. F. Smith; Senior Vice-President: Dr. A. W. Stableforth; Junior Vice-President: Mr. L. E. Rowson; Secretary: Mr. J. A. Moss; Treasurer: Mr. F. A. Edgson; Speakers' Secretary: Mr. R. Clarke.

Council Members. Professor J. A. Laing, Mr. S. L. Hignett, and Mr. A. R. Campbell, were elected to serve for 3 years.

Representatives on B.V.A. Council. Messrs. D. L. Stewart, J. A. Moss, and K. O'Sullivan were re-elected.

Hon. Auditors. Messrs. A. R. Campbell and D. R. Melrose were re-elected.

Scientific Papers

After the luncheon adjournment, papers were presented by Miss A. I. Littlejohn on "Calcium-Phosphorus Ratio in Relation to Fertility in Cattle," by Mr. L. Rowson on "The Influence of Hormones on Cattle Fertility," and by Mr. A. L. Ogden on "The Relationship of Blood Group Factors to Fertility." A lively discussion was led by Mr. S. L. Hignett, the discourse continuing until well after tea. Professor Laing was in the Chair in the absence of the President who had to leave early.

News and Comment

IN PARLIAMENT

In the House of Commons on April 18th, Sir Anthony Hurd asked the Minister of Agriculture if he would make a statement about the functions of the Advisory Council on Rabbit Clearance. In a written reply, the Minister said:—

"My Rt. Hon. Friend the Secretary of State for Scotland and I have decided to extend the purview of the Advisory Council on Rabbit Clearance to include other agricultural pests. The members of the Council have been good enough to agree to an extension of their terms of reference. These are now 'To advise on measures for expediting rabbit clearance and on other matters referred to them in connexion with the effective control of mammals and birds harmful to agriculture.' My hon. Friend the Joint Parliamentary Secretary to my Department (Mr. W. M. F. Vane, T.D., M.P.) will be Chairman of the reconstituted Council.

"The Land Pests Advisory Committee has been dissolved and I want to express my thanks to the Committee for the help which I have received from it. Mr. A. D. Middleton and Mr. F. W. Ward, formerly members of the Committee, and Mr. J. F. Holman and Mr. W. B. Swan have been appointed to the new Council."

LIST OF DISEASES OF ANIMALS

In THE VETERINARY RECORD of January 7th, 1961 an announcement was published about the List of Diseases of Animals. In this note firm orders for the List (estimated price about £1 10s. 0d.) were invited, since it would only be published if not less than 1,500 copies were ordered. For a better understanding of the preparatory work done in connexion with this List the secretary-treasurer of the World Veterinary Association has sent us the following note:—

In 1949 a committee under the direction of Mr. W. A. Pool was charged with the compilation of a List of Diseases of Animals. The report of this committee was presented to the International Veterinary Congress in Stockholm in 1953.

The List was then enlarged by appointing members from national committees in the different countries. As a result of the work done a preliminary manual of the nomenclature of Diseases of Animals was issued in 1957 as a basis for the definitive List. This definitive List is now ready for printing and will be published as soon as the required number of firm orders (1,500) has been received.

FUNDAMENTAL PRINCIPLES OF IMMUNISATION

Messrs. Burroughs, Wellcome and Co. showed their newest film, "Fundamental Principles of Immunisation," on Thursday, April 13th, at the Wellcome building, Euston Road, London.

The film presents some of the principles underlying active and passive immunisation of animals and man by vaccines and anti-sera. Although specially prepared for veterinary and medical students, the film will be of interest to qualified veterinary surgeons, doctors and pharmacists. It is in colour, and runs for 40 minutes.

ANTHRAX SPORE VACCINE

We are advised by the Ministry's laboratory at Weybridge that the production and sale of anthrax spore vaccine by the laboratory is to discontinue. Supplies can, however, be obtained from commercial sources.

POST-GRADUATE CERTIFICATE IN APPLIED PARASITOLOGY

The Post-graduate Certificate in Applied Parasitology and Entomology of the University of London was recently awarded to two veterinarians, Mr. T. Coyle, veterinary research officer in the Overseas Civil Service, who was studying under a leave-grant from the Uganda Government, and Mr. B. A. Matson, recently veterinary research officer in Nyasaland, who attended the course under the auspices of the Commonwealth Scholarship Scheme and as an Honorary Beit Fellow. Both the Beit Fellowship and the Commonwealth Scholarship had been awarded to a veterinary surgeon for the first time.

The course in applied parasitology and entomology, which is held at the London School of Hygiene and Tropical Medicine aims at preparing suitably qualified scientists for research work in the tropics.

MR. F. KNIGHT

Mr. G. N. Gould writes:—

The services rendered by the late Frederick Knight to the veterinary profession were outstanding examples of loyalty and devotion to duty over many years.

He was a kindly man of sterling character, who was able—in a very quiet way—to help and guide each and every President with whom he came into contact. He placed at their disposal his vast knowledge of the members of the Association, scattered over the British Isles, and his prodigious understanding of veterinary affairs in general. He thus forged with every President a firm and lasting friendship.

I remember, particularly, his great work, over long and often weary hours of the day and night during the war time and those post-war years which saw the birth of the modern profession. He never spared himself in his great endeavours to further the aims and aspirations of the Association. The demands made on him by the ever growing and continuing efforts of the Survey Committee were indeed great—yet cheerfully and enthusiastically accepted throughout.

I was privileged to know him as a friend during most of my professional life and to have had close contact with him in the Association over many years.

The sympathy of all who knew him will be extended to his wife and family who meant so much to him.

His name will always be remembered in the more modern history of the profession, to which he gave such great service.

THE SOCIETY FOR GENERAL MICROBIOLOGY

The Society for General Microbiology held its Annual Business Meeting at the Royal Institution on Monday, April 10th, when Professor R. Lovell, of the Royal Veterinary College, took office as President.

Former Presidents of the Society have included the late Sir Alexander Fleming and the late Dr. Marjory Stephenson; this is the first time a veterinary surgeon has been elected to the honour. Others elected to office at the meeting were General Secretary: Dr. S. T. Cowan; Meetings Secretary: Dr. B. Lacey; and Treasurer: Professor K. E. Cooper.

The fifth Marjory Stephenson Memorial Lecture was given by Professor B. C. J. G. Knight, his subject being "The Development of Microbiology." On Tuesday and Wednesday a Symposium was held, the subject being "Microbial Reaction to Environment."

UNIVERSITY NEWS

Bristol

Symposium on Animal Health and Production, April 10th to 13th

The Colston Research Society, which for many years has made grants in aid of research in the University of Bristol, has since 1948 arranged annual symposia on subjects appropriate to the various University departments. The purpose of the Society in sponsoring these symposia is to bring together, for the reading of papers and for discussions, groups of experts in any field chosen from the whole range of the arts and sciences, where research is active. Freedom of choice of subjects gives the Society a much wider scope than that of learned bodies arranging similar gatherings.

The symposium for 1961, arranged by the Veterinary School, had an all embracing title and was intended to bring together workers in different branches of research relating to farm livestock, especially as it is probably true to say that similar opportunities for meeting and discussion arise seldom, if at all.

The membership of the symposium was limited to approximately 60 and all lectures and discussions took place in one of the halls of residence of the University, where accommodation had been arranged for most of the participants.

The folfowing papers were read and fully discussed:—

Dr. A. Dobson (Physiology Dept., Rowett Research Institute) and Dr. A. T. Phillipson (Deputy Director, Rowett Research Institute): *Individuality and the effect of early summer grazing on ruminants.* Dr. Th. de Groot (Laboratory of Animal Physiology, Landbouwhogeschool, Wageningen, Netherlands): *Magnesium intake and utilisation.* Dr. S. J. Bach (Dept. of Physiology, University of Bristol): *Biochemical aspects of bovine ketosis.* Professor J. Bouckaert (Veeartsenijchool, Ghent, Belgium): *Some aspects of bovine ketosis.* Dr. J. G. Campbell (British Empire Cancer Campaign Unit, Poultry Research Centre, Edinburgh): *A physiological and pathological study of sex hormone balance in the fowl.* Dr. P. M. Biggs (Houghton Poultry Research Station): *Observations on the cells from lesions of lymphoid leucosis and fowl paralysis.* Dr. B. R. Burmester (Regional Poultry Research Laboratory, East Lansing, Michigan): *Experimental transmission of avian visceral lymphomatosis and related neoplasms.* Dr. J. J. Bullen (Pathology Dept., Rowett Research Institute) and Dr. A. Dobson (Physiology Dept., Rowett Research Institute): *Bacteriostatic properties of sera and immunity to gas gangrene infection.* Dr. S. E. Piercy (Wellcome Research Laboratories, Beckenham): *Recent progress in the development of living viral vaccines.* Dr. E. J. L. Soulsby (Dept. of Animal Pathology, University of Cambridge): *Immunity to helminths and its effect on helminth infections.* Dr. A. E. Pierce (Institute of Animal Physiology, Babraham): *Antigens and antibodies in the newly-born.* Dr. A. W. Gledhill (National Institute for Medical Research, Mill Hill): *Non-specific resistance to infectious diseases.*

During the evenings informal meetings took place with representatives of the Colston Research Society and members of the University. At the annual reception of the Society the guest speaker was Sir John Ritchie, his subject being "Animal disease control in relation to production." Mr. E. Robinson (President of the Society) introduced the guest speaker and Sir Philip Morris (Vice-Chancellor of the University) proposed the vote of thanks following the presentation of his paper. During the reception, the Society and symposium members were able to see exhibitions on the history of the Royal College of Veterinary Surgeons (arranged by the librarian of the R.C.V.S.) and on the medical history of Bristol (displayed by the librarian of the University).

Members of the symposium visited the Field Station at Langford during one afternoon. There they were able to see demonstrations arranged by the staffs of the School of Veterinary Science and the Ministry of Agriculture Veterinary Investigation Centre.

The papers and the discussions will be published as Volume XIII of the Colston papers. The symposium was directed by Professor C. S. Grunsell, the academic secretary was Mr. M. R. McCrea, and the recorders were Mr. H. Pearson and Mr. A. I. Wright.

HOLIDAY EXCHANGES

Members of the profession on the Continent are making plans for the summer holidays, and the younger members of veterinary families in Britain may be interested in the following requests for exchanges.

France

Dominique Sadorge (aged 14) from the Indre-et-Loire region would like to arrange an exchange holiday with an English girl of the same age in the South of England; the French family would like to entertain their guest for the period July 9th to 30th, the two girls to return to England together for the period July 30th to August 20th, approximately.

Germany

Frau Helga Schmid would like to find a British

correspondent for her daughter (aged 13) and also for herself (aged 34). The family live in Höhnsdorff.

Norway

Dr. Erik Saeter, of Berkak st., 80 km. south of Trondheim in the centre of Norway, has two boys (aged 17 and 15 years) who would like to visit England on an exchange basis for 3 weeks this summer. He would be pleased to entertain the English hosts for a similar period either this summer or next.

Spain

Luis Ruiz del Saz (aged 21) of Cadiz would particularly like to arrange an exchange holiday with a veterinary family in the Birmingham area.

Members of the profession who have accommodation to offer and who would like further retails are asked to contact Mrs. E. M. Stobo, of 211 Yarborough Road, Lincoln.

FAO/WHO EXPERT PANEL ON VETERINARY EDUCATION

It will be recalled that an international meeting on veterinary education, convened by the Food and Agriculture Organisation, took place in London in April, 1960. Probably the most important recommendation of the meeting was the invitation to the Director-General of FAO to establish an international panel on veterinary education jointly with the World Health Organisation. The panel has now been established and consists of the following members: Professor C. Bressou, France; Dr. El Nazir Dafaalla, Sudan; Dr. R. M. C. Gunn, Australia; Dr. William A. Hagan, United States; Dr. T. Lloyd Jones, Canada; Professor S. R. Numans, Netherlands; Dr. T. Ramos Saco, Peru; Dr. R. Rastegar, Iran; Sir John Ritchie, United Kingdom; Dr. L. Sahai, India; and Professor J. Jansen, World Veterinary Association.

The members of the panel will provide expert information and advice on the many subjects to be dealt with to foundations and other bodies interested in supporting veterinary education. In this work they will consult colleagues in the various world regions. Views and opinions will thus be forthcoming from many sources. The panel will meet early in 1962, when the collected material will be reviewed and a beginning made with agreed recommendations.

The Animal Health Branch of FAO will provide organising and secretarial services for the work of the panel, and will welcome reports, comments and information from interested individuals, professional associations and other bodies.

In order to keep veterinarians and others informed on the work of the panel, it is intended to supply the appropriate press from time to time with material for publication.

BINDING "THE VETERINARY RECORD"

We are asked by Messrs. Dunn & Wilson of Bellevue Bindery, Falkirk, Scotland, to mention that their charge for binding individual copies of THE VETERINARY RECORD is 32s. 6d. The sum of 24s. 9d. quoted in THE VETERINARY RECORD of December 17th, 1960, was for technical and research libraries only.

THE BEWICKE AND SHOT PRIZES FOR 1960

The Bewicke and Shot Prizes for 1960 (values £60, £40 and £20) have been awarded as follows:—

First: R. L. Spooner, B.VET.MED., M.R.C.V.S., for his essay entitled "Cerebral Angiography in the Dog."

Second: R. C. Frost, M.R.C.V.S., for his essay "Otitis Externa in the Dog."

Third: L. W. Hall, M.A., PH.D., B.SC., M.R.C.V.S., for his essay "Body Fluids and Electrolytes in Canine Surgery."

THE SUPPLEMENTARY VETERINARY REGISTER

The name of Kenneth Richard Malgarin, Manager's House, Down Farm, Westonbirt, Glos., was restored to the Supplementary Veterinary Register on April 12th, 1961, under the provisions of Sec. 17(2) of the Veterinary Surgeons Act, 1948.

R.C.V.S. OBITUARY

We record with regret the deaths of the following members of the profession:—

GILLING, Gabriel Henry Carolus, The Limes, Dyer Street, Cirencester, Glos. Graduated at the Royal (Dick) Veterinary College, Edinburgh, July 9th, 1953. Died November 30th, 1960.

PRISTON, William Henry, Ryde House, Ripley, Surrey. Graduated London, December 16th, 1913; died April, 1961.

PERSONAL

Mr. Gordon C. Knight was the first recipient of the Blaine Award at the B.S.A.V.A. Congress on Friday, April 21st. The Award is to be made annually by Petfoods Limited, and will be presented for outstanding work in the field of small-animal surgery and medicine.

Engagement

JONES—EVANS.—The engagement is announced between Ronald S. Jones, B.V.SC., M.R.C.V.S., only son of Mr. and the late Mrs. S. Jones, of Chapel House, Racecourse, Oswestry, and Pamela, eldest daughter of Mr. and Mrs. W. Evans, of Bronwylfa, Llanymynech.

Marriage

FRAY—PENROSE-FITZGERALD.—In Guelph, Ontario, on March 8th, 1961, Michael Gilbert Fray, of Kingston, Jamaica, to Cecil Phillippa (Pippa) Uniacke - Penrose - FitzGerald, M.R.C.V.S., B.A., B.SC (VET.), D.V.PH. Present address 14, Orchid Path, Kingston 6, Jamaica, West Indies.

Births

COPESTAKE.—On April 12th, 1961, to Daphne and Peter Copestake, MS.R.C.V.S., a daughter, Catherine Sara, sister for Ann.

SHERIDAN.—On April 11th, 1961, to Maureen (*née* Sullivan) wife of John Sheridan, B.VET.MED., M.R.C.V.S., 77 Norwich Road, Fakenham, Norfolk, a daughter, Corinne Janet.

COMING EVENTS

April

24th (Mon.). EAST YORKSHIRE CLINICAL CLUB. Meeting at the Talbot Hotel, Malton, 8 p.m.

25th (Tues.). WEST WALES VETERINARY CLUB. Meeting at the Golden Lion Hotel, Carmarthen, 7.30 p.m.

26th (Wed.). SOUTHERN COUNTIES VETERINARY SOCIETY. Meeting at the Red Lion Hotel, Salisbury, 7.30 p.m.

ASSOCIATION OF VETERINARY FOOD HYGIENISTS. Meeting during the Royal Society of Health Congress in the Blackpool Cliffs Hotel, North Shore, Blackpool, 10 a.m.

28th (Fri.). LIVERPOOL UNIVERSITY VETERINARY SOCIETY. First Annual Dinner at Reece's Restaurant, 7.30 p.m. for 8 p.m.

YORKSHIRE VETERINARY SOCIETY. Meeting at the Royal Station Hotel, York, 2.30 p.m.

SHROPSHIRE VETERINARY CLUB. Meeting at the Oaks Hotel, Shelton, Shrewsbury, 8 p.m.

29th (Sat.). ASSOCIATION OF STATE VETERINARY OFFICERS. Annual General Meeting in Kent Room, Caxton Hall, London, S.W.1, 4 p.m. Dinner at the Criterion, Piccadilly, 6.30 p.m.

May

3rd (Wed.). SOUTH EASTERN VETERINARY ASSOCIATION. Meeting at Wye College, Wye, Kent, 2.30 p.m.

WEST OF SCOTLAND DIVISION CLINICAL CLUB. Meeting at the University of Glasgow Veterinary Hospital, Bearsden, 7.30 p.m.

4th (Thurs.). CENTRAL VETERINARY SOCIETY. Annual General Meeting at the Royal Veterinary College, Camden Town, N.W.1, 6 p.m.

9th (Tues.). EASTERN COUNTIES VETERINARY SOCIETY. Spring Meeting at the Angel Hotel, Bury St. Edmunds, 12 noon.

25th (Thurs.). MIDLAND COUNTIES VETERINARY ASSOCIATION. Annual Dance at the Penn Hall Hotel, Sutton Coldfield.

30th (Tues.). SOCIETY FOR THE STUDY OF ANIMAL BREEDING. Meeting at the Royal Society of Medicine, 1 Wimpole Street, London, W.1, 11.30 a.m.

September

3rd to 9th (Sun. to Sat.). 79th Annual Congress of the British Veterinary Association at Oxford.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Ayr. High Swinridgemuir Farm, Dalry (Apr. 12).
Ches. Moss Farm, Sandiway, Northwich (Apr. 13).
Perth. Roughstones Farm, Forneth, Blairgowrie (Apr. 14).
Staffs. Seale Fields Farm, Netherseal, Burton-on-Trent (Apr. 11).

Foot-and-Mouth Disease

Worcs. Moat Farm, Cutnall Green, Droitwich (Apr. 14); Camp Farm, Swindon, Dudley (Apr. 15).

Fowl Pest

Berks. 100, Woose Hill Lane, Wokingham (Apr. 12); Bell Farm, Bell Foundry Road, Wokingham (Apr. 15).
Glos. Jeanica, Ledbury Crescent, Staunton (Apr. 11); Spooners Farm, Pillows Green, Corse Staunton (Apr. 12); 1, School Crescent, Staunton (Apr. 14); Parsonage Farm, Brockworth (Apr. 15); Red House Farm, Staunton (Apr. 16).
Norfolk. Fern Bank, Car Lane, Roughton, Norwich (Apr. 16).
Suffolk. Nostra Domus, Furse Close, Thurston, Bury St. Edmunds (Apr. 11).
Surrey. Fowlers Well Farm, Chobham, Woking (Apr. 11).
Worcs. Knightwick Manor, Knightwick (Apr. 14).

Swine Fever

Ches. Wades Green Hall, Church Minshull, Nantwich (Apr. 14).
Derbys. Tops Farm, Monks Road, Glossop (Apr. 12).
Durham. Mount Pleasant Farm, Longnewton, Stockton-on-Tees (Apr. 12); The Quarry, Cobbycastle Lane, Bishopton, Stockton-on-Tees (Apr. 14).
Hants. Borovere Farm, Alton (Apr. 12.)
Lancs. No. 4 Holding, Fallowfield Estate, Fallowfield, Manchester (Apr. 13).
Lincs. Pimlico Farm, Limber, Grimsby (Apr. 11); Dog Kennel Farm, Glentworth, Gainsborough (Apr. 13).
Notts. Bentwell House, Hoveringham (Apr. 13).
Salop. Bridgwalton Farm, Morville, Bridgnorth (Apr. 14).
Warwicks. 102, Colebrook Road, Shirley, Solihull (Apr. 11).
Yorks. Belsom Farm, Yapham, Pocklington (Apr. 11); Overgreen Farm, Burniston, Scarborough (Apr. 12); Southend Farm, Great Broughton, Middlesbrough (Apr. 13).

DISEASES OF ANIMALS ACT, 1950—GREAT BRITAIN
Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period		Anthrax	Atrophic Rhinitis	Foot-and-Mouth	Fowl Pest	Sheep Scab	Swine Fever
16th to 28th February 1961		13	—	52	41	—	45
Corresponding period in	1960	13	—	—	114	—	38
	1959	14	—	1	34	—	49
	1958	9	1	12	14	—	30
1st January to 28th February 1961 ...		51	—	70	370	—	189
Corresponding period in	1960	44	—	7	737	—	177
	1959	35	—	1	181	—	174
	1958	31	1	91	166	—	169

Correction. Return for Foot and Mouth Disease 1st to 15th February 1961 should read 4 outbreaks confirmed and from 1st January to 15th February 1961 18 outbreaks confirmed.

Letters to the Editor

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

The Future of the Profession

Sir,—When I first read Mr. Townson's letter in your issue of April 8th I was inclined to dismiss it as the vilifications of an immature mind, unworthy of of a colleague; but on second thoughts the unreasoned, emotional contents brought vividly to mind the well tried autocratic principle of destruction of a person by denunciation. We have seen in the recent past examples of this in Russia, Germany and America. To be described as a "reactionary," "communist," or "red," brought destruction to the person so described in his native land. Therefore, to dismiss Mr. Townson as an ivory headed right-winger would be I consider, to condone the implied insult to Professor Wright. You may think, Sir, that the word "insult" is too strong, but if one considers the term "woolly-headed left-winger" in the context of the letter, one is left in no doubt that Mr. Townson is contemptuous of the mental ability and morals of a certain group of people of whom he regards Professor Wright as one. The literal translation of the phrase is "immoral half-wit." I do not think that freedom of speech and of the Press is intended for use in this way. Mr. Townson would be better occupied making his remarks orally at Hyde Park Corner and leaving the columns of THE RECORD to members who have reasoned interest in their profession and its future integration into the twentieth century community.

With regard to the nationalisation of the profession, as a nineteenth century anachronism, *i.e.* a single-handed general practitioner, I ought really to object to, and resist any change in my status of rugged individual. However, not having had a holiday for 8 years, and finding that it takes more and more courage with the passage of time to make a quick decision at 3 a.m. to perform a caesarean in a dirty cowshed or equally dirty loose-box, I find that some form of change could be both beneficial and palatable to me. Call the change nationalisation, rationalisation or integration, I am quite unmoved by the name. I had the benefit of working in a nationalised service in Tasmania and I may say that I did not find the experience soul-searing in the slightest. The clients had a service that was as good as any provided by private practice in Britain at that time. As a matter of fact in some respects it was much better as a result of centralisation. No doubt it has altered with changing veterinary techniques. To my mind these changes are the greatest stimulus to consideration of changes in the veterinary structure. In the past Epsom salt and aspirin replaced venesection and those queer formulae (reproduced on occasions in THE VETERINARY RECORD) brewed by witch-veterinarians. In this era we have not scorned to use antibiotics, the large number of useful vaccines, or the various surgical techniques. We have moved with the times in this respect but only in some cases has our professional organisation moved into line with the best use of these techniques and here I refer to the large practices that provide hospitalisation. This is not a gimmick but a parallel to the growth of the motor and chemical industries. A large practice with hospitalisation will inevitably attract more clients and the take-over of small practices like mine will also be inevitable. I must accept that as evolutionary process in veterinary life. There was a time when the small business was ousted by the large chain store and many sentimental tears were shed. The process still goes on but by giving it another name it is accepted as a blessing and has become a cause for rejoicing. Financial experts will no doubt (but I have no specific personal knowledge of this) describe the result as more efficient than the older structure.

In spite of some of the correspondence, I am quite sure that many practitioners value the group practices that have been built up. We have never been a timid profession and we can take pride in ourselves in our daily work. It is these characteristics that would make a success of any form of grouping even to the extent of nationalisation. We have heard some opinions from those who object to grouping but we have heard little or nothing from those who have large practices as to why they continue to enlarge their practices. Equally interesting would be the point of view of the employee of a group practice regarding the benefits of the group. We need this information or we might well condemn a thing of value because of insufficient information. I do not remember the circumstances of medical nationalisation but my impression at the time was that the medical profession was so emotional about the matter that factual information was not to be had from the members with the result that they could take no effective action against objectionable material. It is nonsense to suggest that, because we have some points in common with the medical profession, we are alike.

In my opinion the framework of nationalisation is already with us and I, for one, contemplate its presence benevolently. The Veterinary Investigation Centres and tuberculin testing I find extremely useful. Add to this a national scheme with reference to Brucella abortion and Johne's disease and let the Ministry provide a hospital and buildings from which the practitioners of an area can work for 40 hours or 80 hours—the practitioner can please himself in this matter, and integration could be achieved. It would be a mistake to talk of client practitioner relationships. This is mainly one of money and the farming community have no compunction or qualms about the millions they receive annually in the way of various subsidies. To the profession it would mean an end to the problem of fees.

An earlier letter on the subject was concerned somewhat with the "two breeds" of veterinary surgeons necessary to fit into a nationalised scheme, *i.e.* the large-animal practitioners and the small-animal

practitioners. The apparent difficulties are to my mind negligible. There are ample facilities in the form of abused and misused free clinics to be taken under the wing of a nationalised veterinary service. From this aspect the profession would appear to gain tremendously. Clients of these clinics are, again, not worried by client practitioner relationships; money is the operative factor.

Yours faithfully,
J. CASSELLS.

141, Tettenhall Road,
Wolverhampton.
April 10th, 1961.

A Myxoedema-like Condition in Baby Pigs

Sir,—Recently, a condition has been encountered among baby pigs which resembles myxoedema. The clinical syndrome is variable. Sometimes the piglets appear normal at birth and at others the shape of the piglet is abnormal. Some specimens may be undersized with short legs and a rather short rectangular shape of the torso, others may be so oedematous at time of death that they appear grossly oversize for their age. The whole litter may be affected and die, or part of the litter may show these abnormalities and die within 1 hour and 2 days of age, whereas the remainder may appear normal at birth, yet die shortly afterwards without developing oedema. Some affected piglets may be born dead. To date 1 pig farm in Surrey, 4 in Hampshire and 1 in Sussex have been involved.

At *post-mortem* examination of the most severely affected piglets, the outstanding abnormality has been gelatinous oedema subcutaneously, round the the perineum and along the back. There is also some oedema of the skeletal muscle connective tissues, particularly the hind limbs. In some affected piglets the latter abnormality is the only one visible to the naked eye.

Histological examination of the thyroid and iodine estimations on the gland suggest the condition to be a dysfunction of the thyroid, occurring *in utero*.

Further investigations are being carried out and results will be published in due course.

Yours faithfully,
A. SHAND.

Ministry of Agriculture,
Central Veterinary Laboratory,
New Haw,
Weybridge,
Surrey.
April 11th, 1961.

Bovine Contagious Pleuro-pneumonia

Sir,—The letter of Mr. J. E. Huddart published in THE VETERINARY RECORD of December 31st, 1960, has been perused with considerable interest, and it is thought that readers might be interested in experiences in N.S.W. in the use of the complement fixation test for the eradication of contagious bovine pleuro-pneumonia. Here the disease is only of sporadic occurrence, and outbreaks are always due to the introduction of carrier animals or incubative cases from Queensland, in parts of which State the disease is enzootic. However, it frequently happens that before an outbreak is detected, considerable spread has taken place by virtue of contact with other mobs of cattle and the wide dispersal of infected animals through sale-yards.

In the early days, the disease was controlled by the destruction of affected cattle, vaccination of in-contacts and prolonged surveillance of outbreak mobs. The vaccine employed was pleural exudate from a slaughtered case of the disease which failed to reveal lesions of tuberculosis. As might be expected, results following inoculation of this type of material were irregular, owing to variations in the concentration and virulence of the constituent organisms. Most of these disadvantages, however, disappeared with the advent of the C.S.I.R.O. "Laboratory Culture" vaccine.

When the complement fixation test was introduced, it was decided to control outbreaks exclusively by the frequent testing of all cattle in infected and in-contact mobs in the hope of achieving more speedy eradication of the disease than was possible when vaccination was employed. Experience, however, showed that while the test was highly reliable in leading to the recognition of chronically affected carrier animals, it was only of limited value in the detection of incubative cases, many of which recorded negative reactions. By the time these animals had reacted at subsequent tests or had become clinical cases, further spread of the disease had taken place and this was facilitated by the holding of the cattle in yards where they were in close contact with one another, while the collection of the blood samples for the test was in progress. It was thus found that pleuro-pneumonia when actively spreading could only be eradicated by this means after frequent testing over a prolonged period, during which time many more animals became infected than previous experience indicated would be likely to contract infection if vaccination had been resorted to.

Accordingly, the method now adopted to control outbreaks involves a combination of the complement fixation test and vaccination. When an outbreak occurs, quarantine is imposed, affected animals are destroyed, blood samples are collected from all cattle having contact with clinical cases and at the same time these in-contacts are vaccinated. Stock on adjoining holdings are also vaccinated. Positive reactors detected by the test are slaughtered, and at the end of a 5 to 6 months period there is undertaken a further test which on this occasion embraces all previously vaccinated cattle. By this time almost all the reactions resulting from vaccination have returned to normal. Any cattle positive to this test are slaughtered.

This method is considered to offer the advantage of enabling infected cases recognised by means of the test to be eliminated, while at the same time protecting non-infected members of the herd from affected cattle which fail to react. Results obtained have indicated it to be the most effective of any control method attempted in this State.

While the rapid complement fixation test described

by Mr. Huddart will have the advantage of furnishing an early result, it is feared that it will still possess the main disabilities associated with the standard laboratory test, namely failure to detect incubative cases, and the facilitation of additional spread of infection when cattle are congregated in a confined space for testing.

Yours faithfully,
R. M. WATTS.
Chief, Division of Animal Industry.

Department of Agriculture,
Farrer Place,
Sydney,
New South Wales
March 29th, 1961.

The Effect of Passage Through the Alimentary Canal of the Sheep on the Development of Eggs of *Nematodirus battus*

Sir,—With reference to the recent article under this heading (Everett & Gibson, 1961), may it be that the authors underestimate the significance of their findings?

Remembering the function of the oesophageal groove which, even in the adult ruminant, is said to conduct much of the fluid intake directly to the omasum, may it not be that a large proportion of the eggs administered by drench to the lamb in this experiment, did in fact take this route? The almost complete 72-hour clearance of eggs, together with the fact that by far the greatest faecal egg count occurred in the first 24 hours, both tend to support this supposition.

In the grazing lamb, however, eggs are ingested with solid food and therefore pass first into the rumen. This must surely result in eggs being retained for considerably longer periods of time than this experiment suggests. This in turn might result in the destruction of a much greater proportion of ingested eggs.

Would it not be worthwhile to repeat this experiment, this time administering the eggs in solid food or by way of stomach tube?

Yours faithfully,
ROGER CONNAN.

201, Chesterton Road,
Cambridge.
April 17th, 1961.

Reference

EVERETT, G., & GIBSON, T. E. (1961). *Vet. Rec.* **73**. 293.

Inoculation Certificates

Sir,—During a recent outbreak of distemper, I occasionally had the problem of explaining to owners how their dogs had contracted the disease despite inoculation. Most of these dogs had either been inoculated very recently or else over 2 years ago. The task would have been much easier if there had been a notice on the back of the certificate to say that:—

(1) It takes time for the immunity to develop.

(2) That the vaccine has been thoroughly tested and will *not* cause the disease.

(3) That it is only effective for a limited period and that it is advisable to have a booster dose given later.

(4) That occasionally a dog may fail to develop a complete immunity, so that if in close contact with a diseased dog it should be further protected.

Yours faithfully,
G. R. ROBBINS.

215a, High Street,
Herne Bay.
April 16th, 1961.

An Unexplained Condition of Pregnant Ewes

Sir,—We have seen, for the first time in this practice, the condition of pregnant ewes mentioned by Mr. J. B. White. There have been 2 outbreaks on widely separated farms. All cases have been older ewes, heavily pregnant with twin lambs. The breeds involved were Half-breds and Clun Forest. In one case no supplementary feeding had been given at all and in the other, up to 1 lb. of cake per day was fed, in addition to grass. On both farms there had been cases of prolapse of the cervix and vagina. One case was actually seen as the rupture took place. This was at first a large tense swelling of the vaginal wall which ruptured as the ewe was handled. The cervix did not prolapse.

In the correspondence on the subject various writers have mentioned prolapse of the cervix and prolapse of the vagina. We have noted a marked increase in the former in recent years and now treat it by replacement and fixation with a wire or plastic retainer. These ewes may lamb unaided, but more commonly, there are complications. We are now puzzled by cases of prolapse of the vagina: *i.e.* one side, or rarely both sides, of the vaginal wall appear at the vulva, the cervix remaining in place. These cases can be reduced but are not held in place by a wire retainer. We find the best method is to tie the wool across the vulva. This condition usually occurs some time before lambing and there is, at first, no milk. We have yet to bring a case such as this successfully through lambing. In most cases the lambs are dead and decomposed before the cervix opens, and in the one case on which we performed a caesarean we were evidently too early as the lambs never started to breathe properly. The ewe mentioned in the first paragraph was the only one in which prolapse of the vagina was associated with rupture of the vaginal wall.

We mention this because it is not clear from the recent letters whether other writers distinguish these conditions as separate entities or whether they are usually considered as different degrees of the same thing.

Yours faithfully,
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